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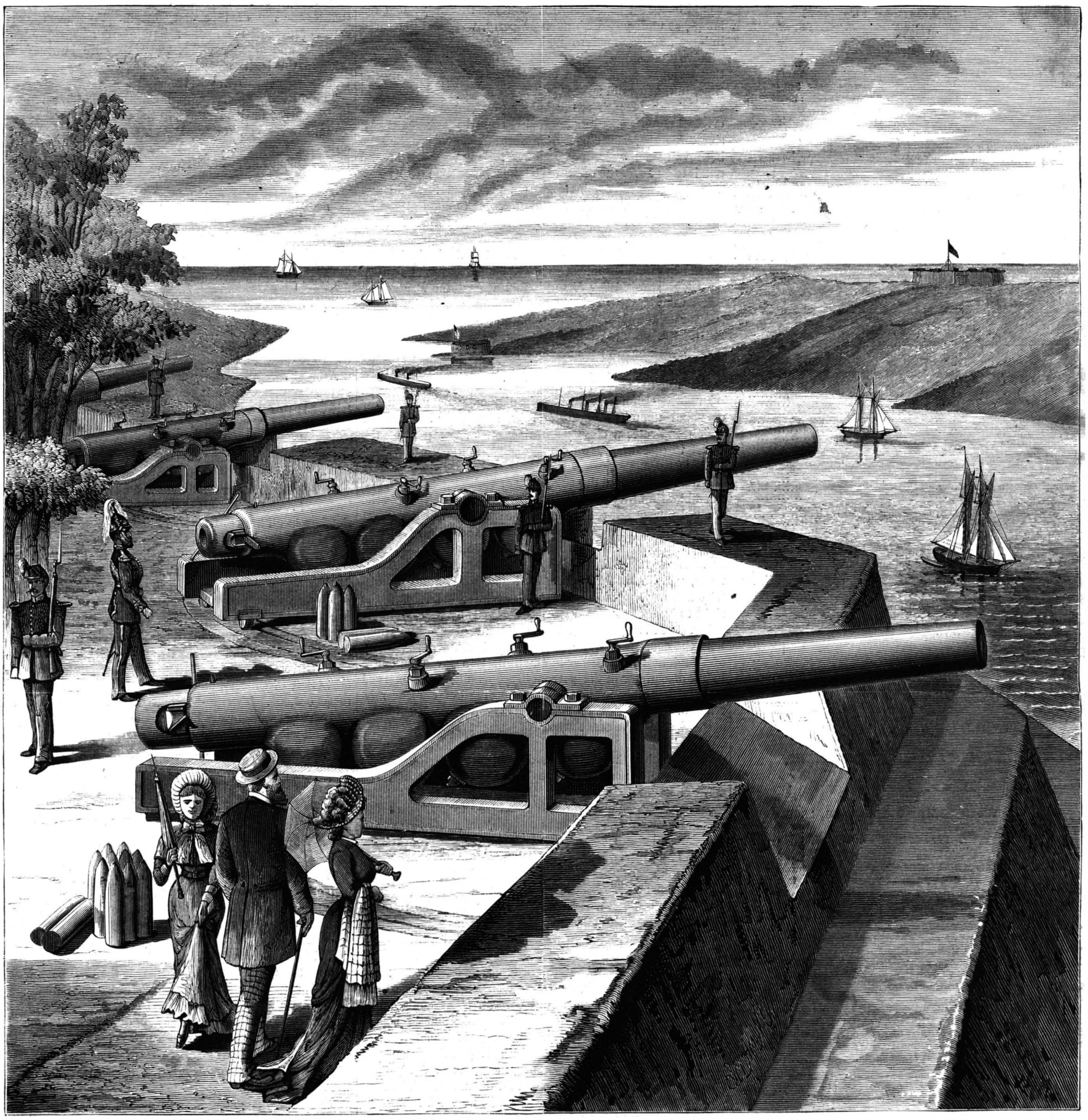

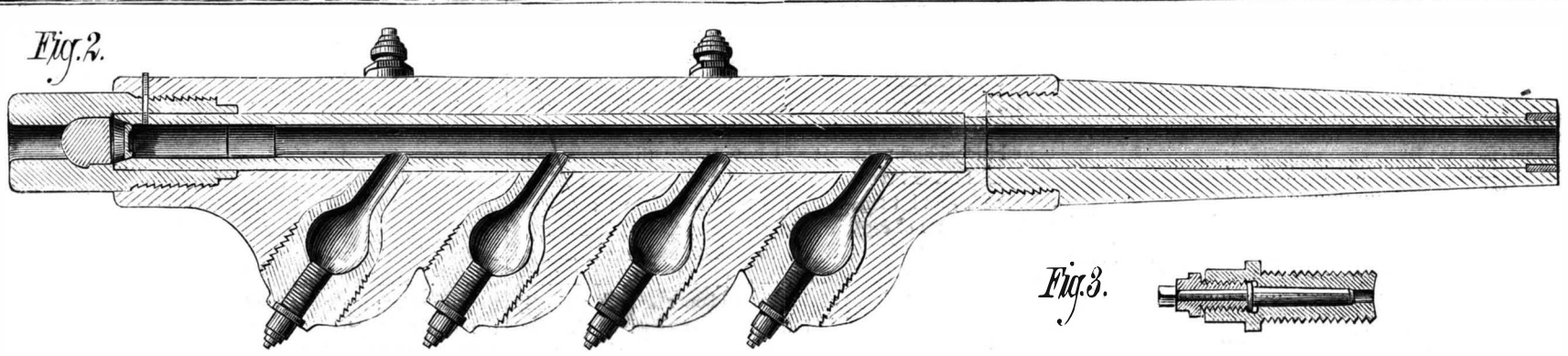

THE LYMAN-HASKELL MULTIPLE CHARGE ACCELERATING GUN.—[See page 51.]

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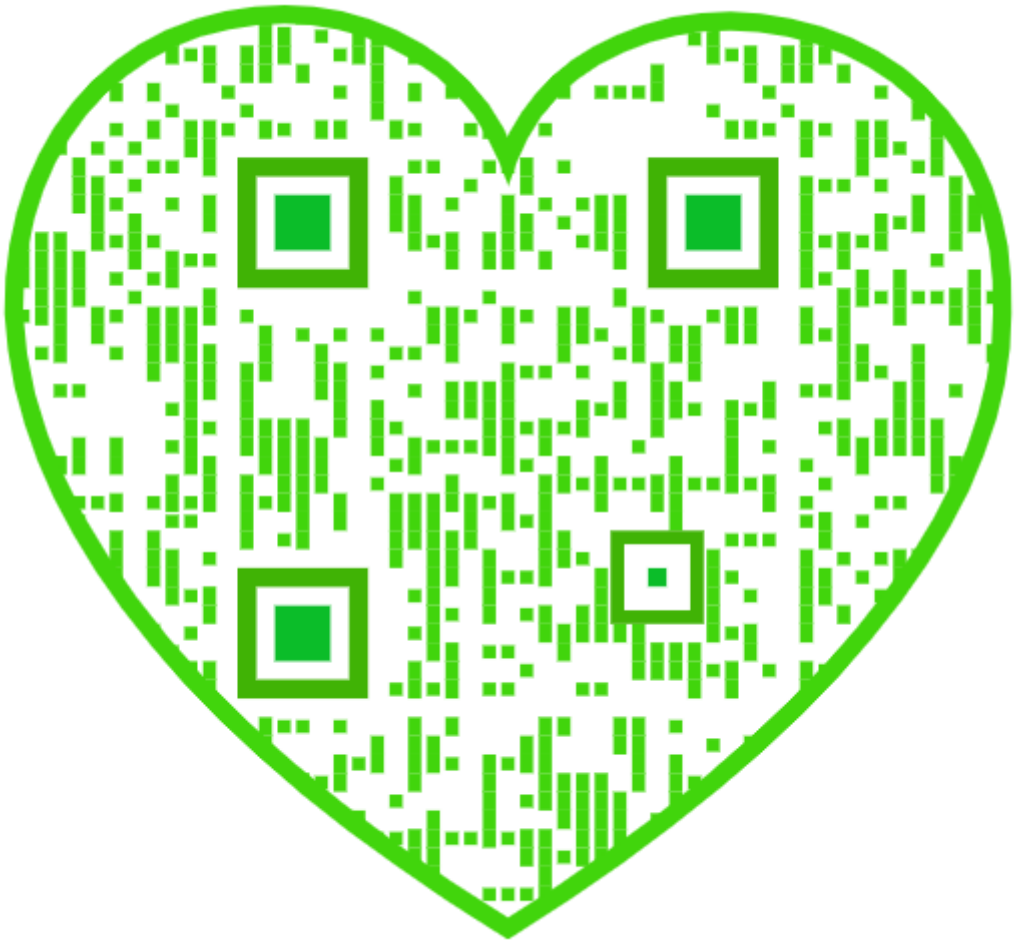

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NEW YORK, SATURDAY, JANUARY 28, 1882.

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FRAUDULENT CLAIMS IN REISSUED PATENTS.

There are hopeful indications that a final stop may be put to the fraudulent acquisition of patent rights by means of reissues, the most fruitful source of complaint against the working of the Patent Office.

A characteristic illustration of this sort of proceeding was brought out in a case lately decided in the United States Supreme Court. A patent was taken out in 1860 for an alleged improvement in lamps. The patent described a combination of devices, including two domes, one over the other, elevated above a perforated cap through which a wick tube and a vapor tube ascended. It was claimed that this combination of devices, especially including the two domes (which admitted the external air between them for producing a more perfect combustion), would allow a chimney to be dispensed with. The invention was a failure, but the inventor and others found that a single dome, used with a chimney, would be a real improvement; and for fifteen years such lamps, as undisputed common property, were manufactured in large numbers for burning kerosene.

Notwithstanding its apparent worthlessness, a reissue of the patent was asked and obtained in 1873, extending the time, but, as would appear, without any material change in the claims. Meantime, the holder of the patent (not the original patentee) had discovered that, had it covered only a single dome to be used with a chimney, the patent would have been valuable, whereupon another reissue was sought and obtained in 1876, the amended claims being made to cover the very thing the original patentee professed to avoid and dispense with. The object, of course, was to make all manufacturers of kerosene lamps tributary to the assignee of the extended patent.

Suit was brought in the Circuit Court of the United States for the District of Connecticut by the holder of the extended patent, Edward Miller & Company, against the Bridgeport Brass Company, to restrain the infringement of the patent and for an account of profits, etc. The court dismissed the bill on the ground that the second reissue was not for the invention claimed in the original patent. The case was appealed to the Supreme Court of the United States, and the decision of the Circuit was sustained.

In his decision Mr. Justice Bradley comments upon the case and upon the matter of reissued patents in a manner which indicates a clear determination on the part of the Court to discourage, so far as possible, further proceedings of this nature.

After pointing out the effrontery of claiming in the reissue a combination involving the specific device which it was the avowed purpose of the inventor to dispense with, the court points out another grave objection to the validity of the reissued patent, namely, that the suggestion of inadvertence and mistake in the original specification was a mere pretence, "too bald for human credence," or if not, the mistake was so obvious as to be instantly discernible, and the right to have it corrected was abandoned by unreasonable delay. "If two years' public enjoyment of an invention, with the consent and allowance of the inventor, is evidence of abandonment and a bar to an application for a patent, a public disclaimer in the patent itself should be construed equally favorably to the public. Nothing but a clear mistake or inadvertence, and a speedy application for its correction, is admissible when it is sought merely to enlarge a claim."

After tracing the historical development of the abuses which have arisen under the laws granting reissues, the court observes that it is clear that it was not the special purpose of the legislation on this subject to authorize the surrender of patents for the purpose of reissuing them with broader and more comprehensive claims, although under the general terms of the law such a reissue may be made where it clearly appears that an actual mistake has inadvertently been made. But, adds the court, by a curious misapplication of the law it has come to be principally resorted to for the purpose of enlarging and expanding patent claims. This is clearly wrong, except where an actual mistake has occurred, not from a mere error of judgment (for that may be rectified by appeal), but a real *bona-fide* mistake inadvertently committed; such, a court of chancery, in cases within its ordinary jurisdiction, would correct. The court adds: "Reissues for the enlargement of claims should be the exception and not the rule. And when, if a claim is too narrow, that is, if it does not contain all that the patentee is entitled to, the defect is apparent on the face of the patent, and can be discovered as soon as that document is taken out of its envelope and opened, there can be no valid excuse for delay in asking to have it corrected. Every independent inventor, every mechanic, every citizen, is affected by such delay, and by the issue of a new patent with a broader and more comprehensive claim. The granting of a reissue for such a purpose, after an unreasonable delay, is clearly an abuse of the power to grant reissues, and may justly be declared illegal and void. It will not do for the patentee to wait until other inventors have produced new forms of improvement, and then, with the new light thus acquired, under pretense of inadvertence and mistake, apply for such an enlargement of his claim as to make it embrace these new forms. Such a process of expansion carried on indefinitely, without regard to lapse of time, would operate most unjustly against the public, and is totally unauthorized by the law. In such a case, even he who has rights, and sleeps upon them, justly loses them."

The significance and importance of this decision need not be enlarged upon. The practice of expanding and idealizing claims in reissues has been the source of serious wrong to the public and of hazard to the entire patent system. The Patent Office, as well as honest inventors and the public at large, is interested in having it stopped.

LOSSES BY FIRE IN 1881.

It is estimated that the losses by fire in the year 1881 are considerably in excess of any previous year, and that on account of the competition among fire insurance solicitors and their companies the fire insurance business of the country has, in the aggregate, been a losing business. The fire hazard has been, with many unscrupulous companies, a secondary consideration, and they have insured anything at more than its value for the sake of the premium, which is practically offering a bonus for incendiarism. Indeed some insurance men go so far as to say that six-tenths of all the fires that occur are of incendiary origin. Another important cause of destructive fires is faulty buildings, especially in villages and smaller cities, where they are built of wood without the least regard to protection against fire either from without or from within.

The *Fireman's Journal* publishes a list of 350 large fires that occurred in this country in the eleven months next preceding December, 1881. It foots up nearly $50,000,000, although it includes only those recorded fires that caused a loss of $50,000 or more. The average loss by each fire appears to be $145,000.

There is also a list of 122 fires in December which has such recorded fires as caused a loss of $10,000 and upward. The aggregate of this list is $7,500,000, and the average loss caused by each is $61,500.

Of unrecorded fires and those causing a loss of less than $10,000, there was probably enough to make the December total as much as $10,000,000.

At this monthly rate, and making due allowance for the season of the year, it appears that not less than $100,000,000 worth of property was destroyed by fire in the year 1881 in the United States, the territories, and the provinces.

A notable feature of the list is the very large percentage of the losses set against the various manufacturing industries. If this list was extended so as to include the smaller establishments that have been wholly destroyed, and the less destructive fires in large mills and factories that have occurred during the year, no doubt the proportion would be greatly increased.

As it is, the list for eleven-twelfths of the year does not include losses less than $50,000. Perhaps three-fourths of the fires in all kinds of factories and workshops caused average losses much less than that amount.

What we can glean from these lists is that there were over sixty woodworking establishments that suffered losses greater than $50,000, amounting in the aggregate to $5,750,000.

Establishments that grind or clean grain, causing the diffusion of fine carbonaceous dust in the closed rooms, stand next in number and in aggregate of losses. There were twenty-five of this class, including grist and flouring mills, breweries, distilleries, and elevators, their losses amounting to $3,000,000. Twenty-five cotton, woolen, and flax mills and cordage works were burned, the loss being $2,500,000.

Of oil works and lard rendering establishments there are in the lists twenty, whose losses foot up also $2,500,000.

LEFT-HANDED GENEROSITY.

A year or two ago a Scotch firm of shipbuilders established what was widely noticed at the time as a "generous" scheme of awards to workmen in their employ who should invent or introduce any new machine or hand tool, or improve any existing tool, or make any other change of means or methods calculated to improve or cheapen the work of their shipyard. The policy was good, though, if our memory serves, it was characterized by shrewdness rather than generosity, since the granting of the award was conditioned upon the surrender by the inventor to the company of the right to use the new invention without further charge. The plan seems to have worked well for the company, who "have been encouraged to amend the scheme" in two important particulars. They now announce that should an invention or improvement be worthy of a greater reward than the sum ($50) originally fixed, the firm will either grant a higher sum, or, should the invention be considered worthy of being protected by patent, pay the inventor $50 and assist him pecuniarily in disposing of his patent or in completing it, at the same time reserving to the firm the right of using such invention themselves free from the payment of any royalty for patent rights.

These offers still keep well within the bounds of prudence, and indicate a sharp outlook for the main chance. The firm enjoy in consequence the pleasure of being generally lauded for generosity. We shall not be surprised if they discover in time that it will pay them to still further encourage the inventive faculty and habit among their workmen, if not by assisting them to take out patents for their inventions, at least without reserving any right of use without payment of royalty. Assistance so rendered might fairly be accredited to generosity; and yet, from a strictly selfish point of view, the generosity would pay handsomely, for the habit of constantly seeking better and more economical methods of working could not fail to make any workman more valuable to his employer, even if it did not lead him to invent anything worth patenting.

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BOILER EXPLOSIONS IN 1881.

The number of boiler explosions in 1881 that have been of sufficient importance to attract the attention of local press reporters is not as great by about half a dozen as was reported in 1880. But the number is quite sufficient, being 160 explosions, by which about 250 persons were killed or fatally injured and died soon after from the effects of their injuries, while over 300 more were seriously but not fatally injured.

Of these explosions almost exactly thirty per centum were in mills that use light and quick burning fuel, sawmills standing far ahead of any of the class in number and disastrous results. The class includes besides sawmills, all such as use the refuse timber and shavings from wood cutting machinery, and should also include such thrashing engine boilers as are fired with straw. But it is not practicable to separate such for the purpose of classification from others that use coal for fuel. It is probable that one-third of all the steam boilers that explode with destructive violence are such as use flashy, quick burning fuel. The furnace doors of such boilers must be often opened, and in the case of green sawdust the draught must be strong, so that when the furnace doors are opened a sudden chill of the furnace plates is caused by the inrushing cold air. The effect of the sudden coaling of parts of the boiler is to unduly contract and strain them, the contraction being resisted by those parts that are not so suddenly cooled. In long cylinder flue boilers, externally fired with flashy fuel, the contraction of the bottom of the shell is resisted by the rigid internal flues. Then the strain causes slight bending of the head flanges, if they have pliable wrought iron heads; or if heavy unyielding cast iron heads, then the strain caused by the contraction of the lower side of the shell is concentrated at the transverse seams, the weakest of which will yield and begin to leak, or it will pull in two between the rivet holes, perhaps one-third the way round the boiler before exploding.

The strains on the flanges of wrought iron heads from contraction of the bottom of the shell of this type of boiler, which contraction is resisted by the rigid internal flues, causes bending at the angle of the flange, and the strained and yielding line near the angle of the flange is at once attacked by the boiler water. The slight imperceptible motion is sufficient to crack off any lime scale that may have been deposited from the water and lay bare the disturbed molecules of the iron, and they are acted on over a larger area than when undisturbed, and with only a small area, that which lies in the general surface of the plate, exposed to chemical action of the water.

The weak line becomes weaker with every recurrence of the motion, and if the weak line is sufficiently long it may give way suddenly on the whole weak line, when an explosion may occur immediately on the escape of the free steam which presses on the highly heated water.

Weaknesses caused from this or any one of the many causes of deterioration of boilers, are, however, not necessary conditions for an explosion. In fact it has been often remarked, and with propriety, "the stronger the boiler the greater the destruction." But it is plain that the force must be greater than the resistance to it when the boiler breaks open. It is only necessary to prevent the escape of the heat by radiation from the exterior surface of a boiler and through all steam outlets, and to continue the fire in the furnace at a temperature higher than that of the boiler water in order to effect a continued gradual increase of heat and of pressure in the boiler. This may be done sufficiently to accomplish the destructive explosion of the strongest boiler by fastening down the safety valve, closing the steam stop valves, and keeping up a moderate fire in the furnace. It is by the accidental arrangement of these conditions that many, perhaps most, explosions of strong boilers that occur are brought about.

It is fair to conclude that farmers and lumbermen who undertake to run their own steam boilers are more likely to make the fatal mistake than almost any other class of steam users. Therefore we need not wonder that so large a proportion as 33 per cent of boiler explosions are in saw and lumber mills.

Next in order of their numbers and effects come the explosions in iron works of various kinds. Something less than 11 per centum of the exploded boilers were in this class of manufactories. The most notable explosions have been in rolling mills and furnaces, but for convenience in classification, boiler shops, machine shops, and foundries are included in this class.

The most important, however, and the most numerous explosions in this class, are iron manufactories proper, and it is these that give this class its right to have this second place in the order of classification, and to these the reader's attention is invited.

Most of the boilers used in iron works in this country are externally fired, although there are a few of the English Rastrick and a few upright flue boilers still in use.

Of the externally fired varieties there are the plain cylinder, the cylinder flue, the cylinder tubular, and the French double cylinder boilers. In iron furnaces it is a common practice to heat the boilers by means of the waste gases from the furnace, and for this purpose the furnace top is closed with a cast iron cover, and a large pipe is let into the side near the top, which conducts the gases to the chamber beneath the boilers, when sufficient air is sometimes admitted to complete the combustion of the gases and heat the boilers.

The sulphurous vapors from the contents of the furnaces are condensed by contact with the cool parts of the boilers, and corrosion sometimes goes on very rapidly, especially near the feed water inlet. Leaks occur, and the moisture from them increases the activity of the corrosive agents, and if not repaired the plates are soon reduced to such a weak condition that they give way. Now, if the break is of considerable extent, giving way suddenly, an explosion may be the result. It is a common saying among engineers that a weak boiler will not explode, but will simply blow out at the weak place, and relieve itself without breaking into fragments. It is true that weak places of smallish area, and surrounded by rigid stays or parts of full strength, often do blow out in this manner, causing damage only to such objects or persons as happen to be in range of the escaping stream of water at the moment; but it is also true that if the weak place happens to be of such extent and so located as to break with a snap and make a large opening through which the free steam instantly escapes, the explosion of the highly-heated water may break the boiler into fragments more or less completely, according to the relative quantity of water, its temperature, the [illegible] and location of the initial opening, and the direction in wh[illegible] the escaping water acts on the unsupported plates. But the conditions are so various that it is the veriest quackery to predict a specific set of results in any given case.

Puddling and reheating furnace boilers are often placed so that the gas from the burning coal is driven first through the reverberating chamber, where the ore, the bloom, or the iron pile, as the case may be, is placed to be heated; thence urged by a blast fan, it enters the chamber beneath the boiler, or in case of the upright flue boiler, it enters the flue or flues which pass upward to the stack.

If the intensely heated gases impinge directly on a limited area of the boiler shell or flues in a concentrated blowpipe stream, it is sometimes impossible for the iron to transmit the heat to the water as rapidly as it is delivered by the blast on the small area of the iron plate. The iron may thus become weakened by being crystallized, and especially if a seam is thus exposed; because there the lap not only doubles the thickness of the metal between the hot gases and the water, but also there is less rapid transmission on account of imperfect contact of the plates, and of the rivet heads with the plates.

Sudden cooling of long externally heated boilers that are insufficiently or improperly supported causes very severe strains on the shells of iron works boilers. They are sometimes as much as twenty diameters in length, and when such boilers have three or more supports the distortion caused by the unequal heating sometimes throws the entire weight upon the middle and end supports alternately as the boilers are heated and cooled.

Overpressure, generally accidental, has, no doubt, contributed a full quota to disastrous explosions of iron works boilers. Safety valves that "breathe" a little on occasions, indicating to the unpracticed or thoughtless attendants that they are ready to take care of the steam in case the demand for it is stopped by the sudden shutting down of the works, are not always capable of opening sufficiently to discharge the full volume that may be produced by an active fire. One such safety valve is often expected to relieve three, four, or half a dozen large boilers with steam outlets closed and heavy fires burning. Then, if any one of the lot has a sufficiently extensive weakness, no one who knows and thinks about the conditions would be astonished if the weak boiler should blow up and break its nearest neighbor, which in turn might break the next one if no sufficient masonry was there to prevent it.

In one case, eight boilers in a lot of ten, in a sawmill, are reported to have been blown to pieces in the past year. And a few years ago nine boilers likewise exploded in an iron-making establishment in Ohio.

There is a prevailing idea among attendants of steam boilers, more especially those in iron works, that no boiler will explode while there is sufficient water in it to prevent overheating of the fire surfaces, and this idea is entertained by many intelligent iron masters, which is unfortunate, because they naturally take less precautions in keeping a full safety margin of strength in their boilers than in keeping a full supply of water, perhaps the colder when pumped in the better.

Railroad locomotives usually stand near the head of the list, generally in the third place, but this year only about seven per centum of the explosions have been locomotives; thirteen only have been reported, and the same number stands against steamers.

Portable engine boilers, hoisters, pile drivers, and thrashing machines stand third in this year's classification, which is not surprising in view of the extended introduction of agricultural and thrashing engines.

In distilleries, breweries, soap and candle works, and the like, there have been eleven boiler explosions

In steam heating and drying and in dwellings there have been seven cases of disaster.

In bleacheries, dyeing, digesting, and other works where steam and water are used in vessels remote from the generator, there have been six cases of destructive explosions. There have been during the past ten years as many as thirty-five or forty of this class of explosions. This fact, if known and understood by those who believe in explosions from low water alone, ought to shake their faith in their own creed, since there can be no such thing as overheating of plates about a steam chamber remote from the generator and heated only through a small steam pipe. These cases are in all respects similar to those of steam generators. They burst and fly in a similar way, the destruction usually corresponding to the amount of the contained water and its temperature, the same as in a generating vessel that is exposed to the fire. It is not probable, however, that so great a percentage of this class go to pieces as is found among generators, because they are not exposed to so many deteriorating influences as regular steam boilers are. There have been enough, however, to fully establish the fact that it is not necessary that a boiler should be empty or partly so in order to produce a destructive explosion.

In the ninth item in this classification, viz., paper mills, flour mills, grist mills, and grain elevators, there have been *five* explosions.

In the tenth—cotton, woolen, and knitting mills—*four;* in mines, oil wells, etc., *three;* while there have been nineteen explosions in other mills and works not characterized in the press reports.

RECAPITULATION.

	Explosions in 1881.
(1) Sawing, planing, and woodworking mills	48
(2) Iron works	17
(3) Portables, thrashers, hoisters, etc	15
(4) Steamers, tugboats, etc	13
(5) Locomotives	13
(6) Distilleries, breweries, soap works	11
(7) Dwelling, steam heating and drying	7
(8) Bleaching, boiling, digesting, and dyeing	6
(9) Grist, flour, and paper mills, and grain elevators	5
(10) Cotton, woolen, and knitting mills and factories	4
(11) Mines, oil wells, and works	3
(12) Mills and works not classified and those not characterized	18
	160
Number of persons killed	250
Number of persons injured	328

ELECTRICAL SHEEP SHEARS.

Mr. Edison has referred to us a communication from New Zealand in which the writer sets forth at length the pressing need of some means of shearing sheep evenly, rapidly, and without risk of hurting the animal. Sheep raising, it will be remembered, is most largely carried on in sparsely inhabited districts where skillful shearers are hard to get.

The writer appeals to Mr. Edison, thinking that an electrical apparatus might be made to answer, the cutting to be done by means of a wire highly heated by an electric current. The length of the heated wire or cutter would have to be about three inches.

The use of an incandescent wire of platinum for cutting has been entirely successful in surgery, in removing tumors and other diseased or morbid growths, and there is a possibility that it might answer for cutting wool. Whether the heated wire would injure the wool, or whether the accumulation of ash would speedily make the cutter inoperative, are questions which trial alone can decide.

Some years ago patents were taken out for a method of felling timber by the use of wire electrically heated, but when the method was put to practical test it failed, as the ash of the burnt wood soon surrounded the wire with a fireproof shield.

Whether a similar difficulty would arise from the coating of the wire with wool ash and charred wool on applying the method to wool cutting, and whether this or other possible difficulties can be easily overcome in an electrical shearer, can be determined only by trial.

A Curious Appearance of the Moon.

A singular appearance of the moon was observed by several residents of Lebanon, Conn., on the evening of July 3. The moon, almost full, was about three-quarters of an hour high. An observer says: "Two pyramidal luminous protuberances appeared on the moon's upper limb. They were not large, but gave the moon a look strikingly like that of a horned owl or the head of an English bull terrier. These points were a little darker than the rest of the moon's face. They slowly faded away a few moments after their appearance, the one on the right and southeasterly quarter disappearing first. About three minutes after their disappearance two black triangular notches were seen on the edge of the lower half of the moon. These points gradually moved toward each other along the moon's edge, and seemed to be cutting off or obliterating nearly a quarter of its surface, until they finally met, when the moon's face instantly assumed its normal appearance. When the notches were nearing each other the part of the moon seen between them was in the form of a dove's tail."

Table of Early American Patents.

In the January issue of the *Journal of the Franklin Institute*, is a useful "chronological table of American patents granted between 1825 and 1859," prepared by the librarian of the institute, Mr. E. Hiltebrand.

The period covered was one of great activity and originality among American inventors, and though the *Journal* table is not exhaustive (since it includes only such patents as were mentioned in the issues of the *Journal* during the period covered), it is likely to be of use to many.

A Year's Production of Window Glass.

At a meeting of the American Association of Window Glass Manufacturers lately in Washington, the product of the past year was reported to have been nearly 2,250,000 boxes, valued at about $6,000,000. The demand for consumption has taken the entire product.

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A New Fire Escape.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. John E. Codman exhibited drawings of and described Nicholson's fire escape, which consists of a fireproof brick tower, octagonal externally and cylindrical internally, with central shaft about 18 inches diameter, around which is formed a winding passage, of a U-shaped section, 2 feet 3 inches in width, with smooth or glazed surface, and inclined at angle of 35°, with retarding curves of less gradient. Fireproof doors would connect with each floor and roof, and a vestibule with the surface of the ground below. It is intended that those escaping shall assume a sitting posture on entering the spiral and slide to the bottom, and it is claimed to be safer than other escapes for those unaccustomed to ladders, or weakened by fright or excitement.

IMPROVEMENT IN STEAMBOATS.

Every boatman knows that the angle and depth at which the wheels of steamers strike the water affect very greatly their speed and power of propulsion, involving as a consequence the questions of time and consumption of fuel. The loading and unloading of a vessel alter the dip of the paddle; the heavier the load the greater the dip and angle, destroying the effective power of the engine. To remedy this difficulty many devices have been planned, the best of which are only partially effective, all more or less complicated, and the additional machinery being very liable to get out of order. The most common plan for side-wheel boats is the feathering wheel, which makes each paddle strike the water at right angles, but when deep in the water the power is applied at a great disadvantage, and too much of the wheel submerged for effective use.

A wheel large in proportion to the size of the boat and capacity is generally accepted as a solution of the difficulty; the vessel being constructed so that the load will not sink her below a line of effective working power. In stern-wheel boats the load is mainly carried on the bow, so that they do not run on an even keel, and the resistance of the water through which they plow their way is greatly increased. Other craft of this kind raise and lower the wheels by several devices not applicable to large and powerful boats.

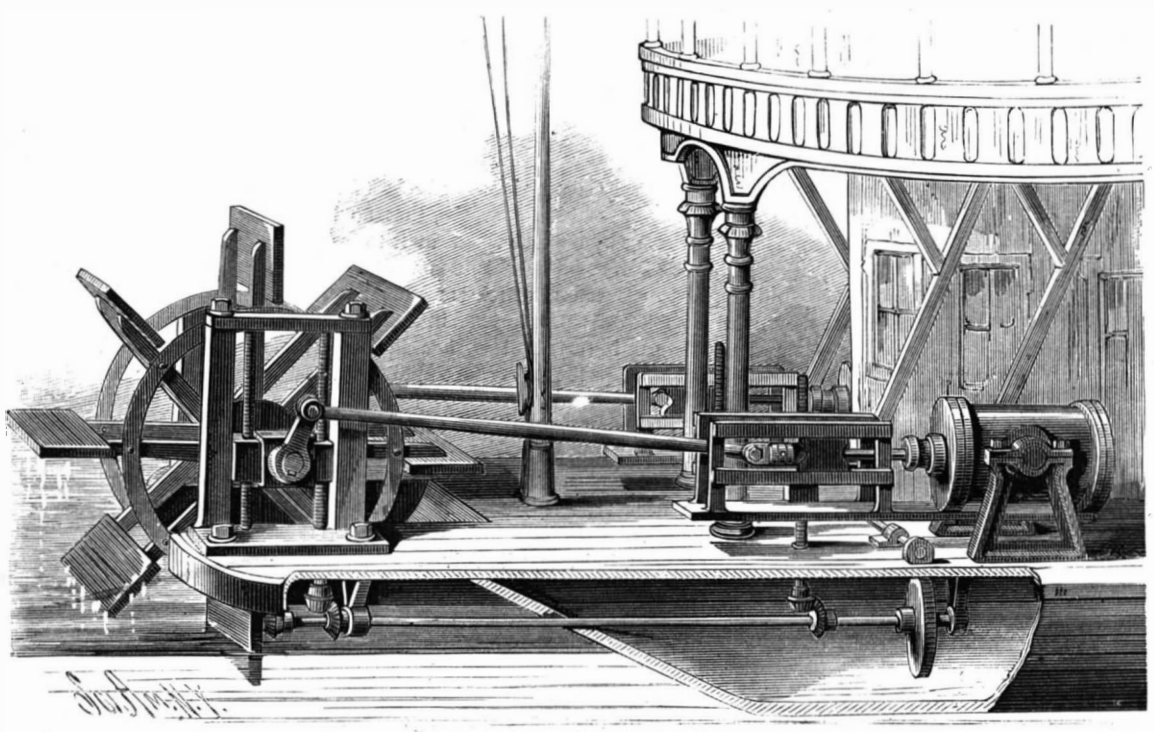
Mr. Robert L. Stevens, of Albany, Oregon, has recently patented a device which raises and lowers the wheels of either side on stern-wheel boats, so that whether the vessel be loaded or unloaded the paddle will strike at the most effective angle and depth, securing the greatest speed with a minimum of power, while the driving engines are not interfered with. This is effected by a series of screw shafts arranged for simultaneous movement by the driving engine, and they do not detract from the strength of the wheel or boat. The arrangement is not complicated, and adds but comparatively little to the weight.

The advantages of this improvement are many. The wheels and engines of large boats can be made smaller and driven faster, economizing weight and fuel, the destructive jar of an overloaded boat and its powerful engine obviated, increasing the durability of both. They can be deeply loaded without changing the paddles to a smaller diameter, as is often done on the Mississippi. They can be built deeper and longer, doubling or tripling their capacity in deep rivers. With light loads they can run up the shallow rivers at full speed, and thus avoid expensive transfers of freight, and their draught only limited by the depth of the rivers in which they ply. For example, a vessel drawing twelve feet of water when loaded with 1,000 tons, could start from New Orleans, leave portions of her freight at the great centers of commerce, and with a light load left, say 150 tons, and drawing three and a half feet or less, mount the swift and shallow tributaries of the Mississippi, carrying freight directly to its destination instead of transferring it to a steamer of lighter draught.

The paddle wheel and its shaft are supported at the stern of the vessel, as shown in the engraving, by boxes which are formed with side flanges entering grooves formed in fixed posts, so that the boxes are free to be raised and lowered. Screw shafts, supported at the top and bottom, pass through the internally threaded flanges of the boxes, so that the boxes with the wheel and shaft are sustained by the screws. On the lower ends of the screws, at each side, there are bevel gear wheels meshing with similar gears on shafts that are fitted longitudinally of the vessel at each side.

The cylinders are hung for oscillation on trunnions, and the slides are connected to the cylinders so as to retain their proper relative position. A screw is fitted in connection with a nut on each slide, for swinging the slide and cylinder and sustaining them. All of the screws are connected for simultaneous operation. The movement being in an arc from the trunnions, the screws and bevel gearing are proportioned to obtain the variation in movement. To allow vertical movement of the boxes the piston and eccentric rods are fitted with right and left hand screw turn buckles, so that the rods can be lengthened and shortened.

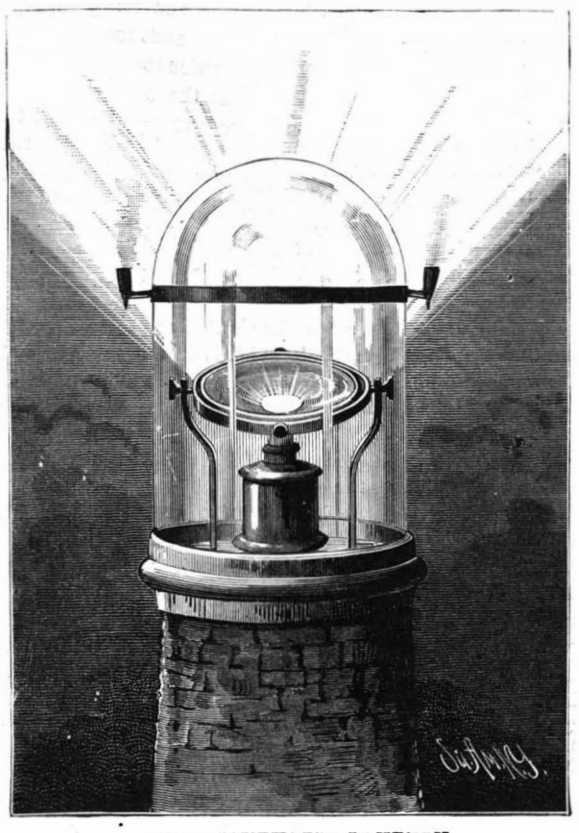
The invention can be applied in connection with side paddlewheels and beam engines by changing the relative position of the parts.



STEVENS' IMPROVEMENT IN STEAMBOATS.

IMPROVEMENT IN LIGHTHOUSE LANTERNS.

The engraving represents a novel lighthouse lantern recently patented by Mr. Oliver Cook, of Darien (Rowayton P. O.), Conn.



COOK'S LIGHTHOUSE LANTERN.

The lantern is provided with a glass dome or cover, and a concave ring reflector in a gimbal, provided with clamping screw pivots to hold it in any desired position.

The tower of the lighthouse is constructed in the ordinary manner, and supports the lantern, the sides of which are made of glass, secured to a frame attached to the top of the tower. The top of the lantern or lamp chamber is made of glass, arched in the form of a dome, and supported by the lantern frame. The glass dome may be made in one piece or in sections, as may be desired. The lamp is of the ordinary description. The reflector is a circular concave disk with a hole through its center, through which the flame of the lamp projects.

The pivots of the gimbal are screws which permit of clamping the rings of the gimbal in place when the reflector is adjusted in the proper position to throw the light vertically or at any desired inclination.

By this construction the light may be thrown upward against the clouds, and will be reflected by the clouds so that it can be seen at a much greater distance than is possible when the light is thrown from the lantern in a horizontal direction. The adjustment of the reflector depends upon the state of the air. The gas from the lamp escapes from the lantern through two or more elbow pipes. The lower arms of these pipes incline slightly downward, so that any rain that may fall into the open upper ends of the pipes cannot flow into the lantern, but will escape through small tubes connected with the pipes at their angles. The air to support combustion is admitted through openings in the bottom of the lantern.

This invention was suggested to the inventor by seeing the lights of New York city reflected from the clouds fifty miles distant from his home.

This style of lantern will enable vessels coming in from the sea to get the bearing of the harbors in dangerous weather much sooner than they could with the old form of lighthouse.

These lights could be made to flash, or they may be colored to distinguish them from other lights.

RECENT INVENTIONS.

Mr. Josiah Wormuth, of Kinney's Four Corners, N. Y., has patented an improvement in the class of farm fences in which the rails or boards forming the panels are supported by means of wires attached to the posts. Boards, rails, or poles are used to form the panels, and instead of posts set in holes dug in the ground the inventor uses stakes which are sharpened to adapt them for driving, greatly facilitate the erection of the fence or its removal from one place to another. The invention relates particularly to the manner of applying and securing the wires to the posts or stakes. In addition to forming the eyes to receive the rails, the larger loops depend below the rails so that the weight of the rails causes a direct downward pull on the nails, and the pull or strain is mainly lateral, so far as relates to the lower nail of a pair. The result is, that the nails and wire are subjected to less strain, so that the nails retain their hold in the post longer, and the wire may be of smaller size, and will remain intact or unbroken for a longer time.

A novel toilet fan has been patented by Mr. James C. Stirrat, of Brooklyn (E. D.), N. Y. The object of this invention is to provide a new and improved fan which can also be used as a new and very amusing toy. The invention consists in a fan made of a circular or polygonal sheet of pasteboard, metal, or other suitable material, suitably ornamented, and pivoted on the fan stick or handle so as to revolve freely on its pivot. It is provided with a central ring, and a series of radial lines dividing it into a number of equal or unequal spaces, which may contain advertisements, etc., or they may contain mottoes, verses, names, letters, etc., or pictures of animals, nursery scenes, etc. It will afford children and others much amusement to revolve the fan and observe to which space the pointer points when the fan stops.

Mr. Amant H. Ohmann-Dumesnil, of St. Louis, Mo., has invented an improved device for holding stair carpet in such a manner that it can be removed or replaced and fastened conveniently and quickly. The invention consists of a latch provided on its under side with one or more studs or pins and pivoted to a prismatical or beveled plate or block which is secured to the riser and tread at the angle formed by the same, the carpet being placed over this block and held in place by the latch, which is closed down upon the block, the pins passing through the carpet into apertures in the block, the latch being locked by a spring or a pivoted catch.

An improvement in lead pencil holders has been patented by Mr. Edward Weissenborn, of Hoboken, N. J. The object of this invention is to facilitate and cheapen the manufacture of lead pencil holders of that class in which the lead is held by a spring-pressed divided point.

Mr. Henry H. Welch, of Cincinnati, O., has patented an improved car switch manipulator which is especially adapted to street car switches. The object of the invention is to enable the driver of the car, by means of suitable attachments to the front of the car, to operate the switch.

Mr. Frank N. Forster, of Buffalo, N. Y., has patented an improvement in tanks for storing petroleum, the object being to protect the tanks from the effects of lightning. It is well known that a rising quantity of gases attracts lightning; this inventor has, therefore, taken all possible precaution to prevent the escape of gases from the oil tank. If considerable quantities of gas accumulate in the tank and the pressure increases, a valve is opened by the pressure, and the gases are conducted to places some distance from the tank. If the gas should become ignited, the valve prevents any return of the flames into the tank.

An improved chain-work for jewelry, formed of interlocking spiral wires and crossbars in every other coil, the side edges of the crossbars and wires being folded over the body of the chain-work, so that soldering is rendered unnecessary, and polished crossbars may be employed, has been patented by Mr. Emile Vieille, of Providence, R. I.

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Mr. Lawrence W. Chadwick, of Shenandoah Iron Works, Va., has patented an improved sectional steam boiler, composed of several horizontal water and steam chambers set one above the other within a casing or shell closely fitting against their edges and supported and connected by vertical and horizontal water circulating pipes and T's, the chambers having vertical openings through them, that serve as flues for the passage of the products of combustion; and it consists, also, in combination with the chambers and tubes, of a fireplace, water front, and of novel pipe coupling devices.

An improvement in car couplings has been patented by Mr. Samuel A. V. Hartwell, of Valley Center, Kan. The invention consists of the combination of a draw-head having a sliding cap for regulating the size of the coupling entrance, a notched coupling pin for adjusting the link, and a flat link having grooved ends.

Mr. Noah Jacobsohn, of New York city, has patented an underground street, the object of which is to facilitate the removal of street sweepings and refuse garbage, ashes, snow, etc., and to provide a road for the vehicles for removing these sweepings, garbage, etc., whereby the streets can be easily and economically kept clean. The invention consists in an underground road or street occupying a part or the entire width of the street, and having a roof of grating flush with the ordinary street, through which the sweepings, snow, garbage, etc., are swept or dumped into the cars or carts on a track of the underground road.

An improved spark arrester has been patented by Mr. David Wiser, of Plymouth, Ind. This invention is an improvement upon the spark arresters described and claimed in Letters Patent Nos. 165,907 and 210,828, which were granted to the same inventor July 20, 1875, and December 10, 1878, respectively. The improvement renders the device more adaptable to smoke stacks which are straight. The spark arrester will return to the fire box a considerable portion of the smoke and gases, where they will be consumed and utilized as fuel.

Mr. Frederick Shriver, of Grand Rapids, Mich., has patented a steam generator which has the base burning feature embodied in it, and which is designed for low pressure heating purposes and for domestic work, and which has no tube or crown sheet to protect by a fixed water line. The invention consists of an upright boiler of U-shaped cross section, having a double shell inclosing the water space, curved in such a manner that one shell or wall forms the exterior of the boiler and the walls of the interior central fuel reservoir, while the other and concentric shell forms the walls of the interior smoke flue of the boiler, through which pass the heat and products of combustion, thereby forming an interior and an exterior water chamber connected with each other.

An improved car coupling has been patented by Mr. John Cochran, Jr., of Millwood, Mo. The car coupling is constructed with wide bumper heads, with two pairs of links, a pair of pins, slotted sliding bars, connected with a pin of each pair, and pivoted lifting bars connected with the slotted sliding bars and swinging trip blocks, whereby t he cars will be coupled automatically as they are run together.

Mr. Frederick A. Fargo, of Pine Woods, N. Y., has patented a hop picker's measure or box that may be easily taken apart for stowing away in small space and for transportation, and easily set up for use.

The Anthracite Product of 1881.

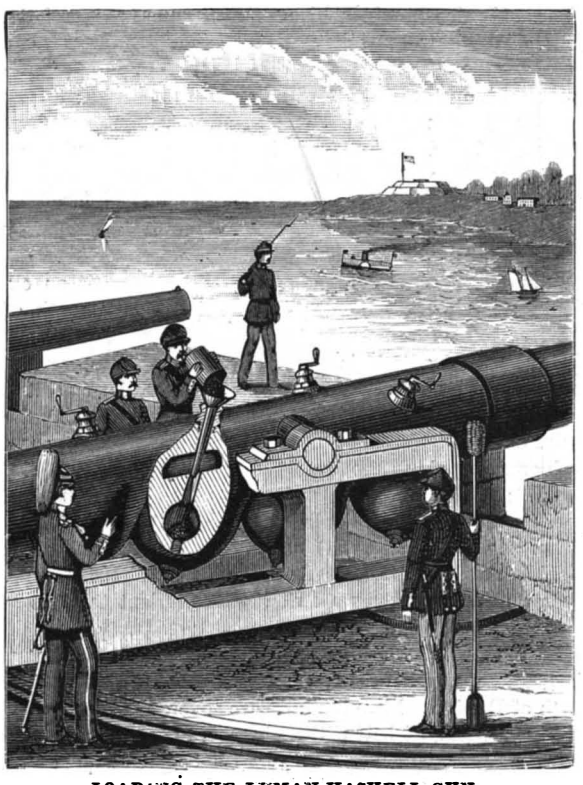
The official report of the anthracite tonnage of the Pennsylvania railroads for the past year shows a traffic of 28,500,016 tons, an increase of 5,032,774 tons as compared with the previous year. Of this amount the Philadelphia and Reading Railroad carried 6,940,823 tons, the Lehigh Valley Railroad 5,721,869 tons, the Central Railroad of New Jersey 4,085,423 tons, the Delaware, Lackawanna and Western Railroad 4,338,968 tons, the Delaware and Hudson Canal Company 3,211,496 tons, the Pennsylvania Railroad 2,211,363 tons, the Pennsylvania Coal Company 1,475,385 tons, the New York, Lake Erie and Western Railroad 465,230 tons. Of the total production, 48·96 per cent was from the Wyoming region, 18·58 per cent from the Lehigh region, and 32·46 per cent from the Schuylkill region. The stock of coal on hand at tide water shipping points was 497,024 tons.

A Characteristic of American Life.

In the summer of 1836 a barefooted boy was on his way to Honesdale, Pa., walking the tow-path of the Delaware and Hudson Canal. When four miles from Port Jervis, and still forty miles from his destination, he was overtaken by a canal boat. He was asked to jump aboard the boat and ride, which he did. On the boat was a Scotch family, just landed in America, who were on their way to the Pennsylvania coal fields. One of its members was a boy the same age of the young pedestrian, eleven years. A strong friendship grew up between the two boys by the time they reached Honesdale. The Scotch family went on to Carbondale, the center of the Lackawanna coal field. The boy who had been given the ride in the boat obtained employment on the canal. His friend, the Scotch boy, worked in the mines for a short time as mule boy. Both he and the former barefoot boy rose in the company's service. The Scotch boy of forty-six years ago is Thomas Dickson, President of the Delaware and Hudson Canal Company. His friend, the other boy, is Col. F. Young, General Manager of the company, and President of its Albany and Susquehanna Railroad system.—*Sun.*

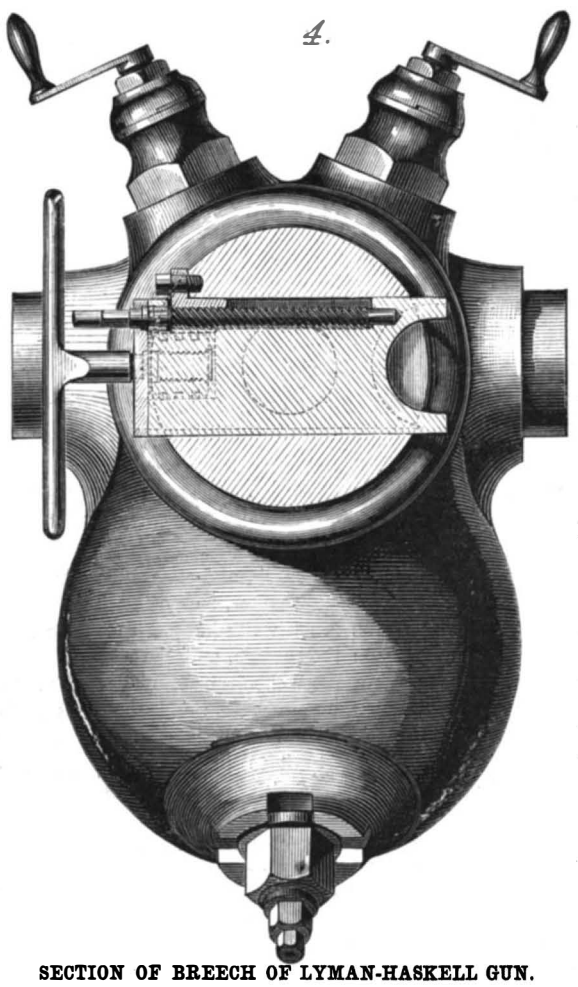
THE MULTICHARGE CANNON FOR COAST AND HARBOR DEFENSE.

It would seem to be the rule in military as well as in other arts, that radical improvements are more apt to be made by non-professionals than by those whose lives are devoted to the particular art or service improved. The latter perfect the means and methods which they are educated to use; they do not revolutionize them. It is the outside inventor who sees where radically novel changes can be advantageously made. Freedom from professional bias is often, indeed, a prerequisite for successful effort in invention. And it may be that the professional prejudice which the inventor of striking boldness and originality is sure to encounter is one of the conditions of a thoroughly practical development of his ideas.



LOADING THE LYMAN-HASKELL GUN.

When the stress of war was upon the country, twenty years ago, the attention of our inventive minds was largely directed to the production and development of military and naval devices, some of which, like the revolving turret, the breech loading rifle, and the magazine gun, had been dormant, so to speak, for years. Other ideas, equally revolutionary in character, were suggested by the needs of the time, but the war was happily ended before they could be developed. Among these was the idea of increasing the efficiency of firearms, particularly heavy guns, by what is now known as the accelerating principle. Since then the original idea of Mr. Lyman has been developed and practically applied by Mr. Haskell, in the multicharge cannon, the construction and mounting of which are illustrated in the accompanying engravings; an invention which promises to work as radical changes and improvements in military and naval operations as were effected by those other American inventions—magazine guns, torpedoes, revolving forts, ironclads, and the rest.



SECTION OF BREECH OF LYMAN-HASKELL GUN.

In the contest between the increasing weight and power of cannon and the resisting strength of more and more heavily armored defenses, two radically different lines of effort have been followed. Within the profession, capacity in guns to hurl heavy projectiles at great velocity has been sought for by increasing the size and strength of the gun; by chambering the breech to make room for a large volume of powder to be exploded, and by moulding the powder to secure accelerating combustion, slow at first to start the projectile, then more and more rapid to burn all the powder and attain the maximum pressure while the projectile was passing through the gun. By these improvements it has been found possible to increase the charge of powder to one-fifth the weight of the projectile, enabling a properly constructed gun to deliver a shot with such force and velocity as to cause it to penetrate somewhat more than as many inches of iron as the diameter of the bore of the gun measures. Under the most favorable conditions the heaviest armstrong gun (100-tons) has penetrated nearly one and a half calibers, or about two feet of wrought iron, with a caliber of seventeen inches. Increase of efficiency is secured on the accelerating principle by devices for firing successive charges of powder behind the ball while the ball is passing through the gun. In this way the projectile is thrown by the explosive force of more than its weight of powder, or five to ten times as much as can be burnt behind a ball by the conventional method.

The inventors claim that, notwithstanding the greatly increased charge of powder under the new principle, the maximum pressure within the gun is not increased. By the old method almost all the strain is upon the metal about the breech of the gun, while by the new the strain is distributed along the entire length of the gun. As a natural consequence of the increased charge a longer and heavier projectile can be employed, and the increased velocity with which it leaves the gun enables it to penetrate iron armor to a depth from four to ten times the caliber of the gun, according to the number of accelerating charges.

Two official tests of the efficiency of multicharge guns have been made before boards of officers of the army and navy, some of the experiments being made for range, others for penetration, and still others for initial velocity. On every point the reports show a decided superiority in favor of the multicharge guns, compared with other guns of equal or greater weight. So marked is the superiority of the accelerating principle that General John W. Newton, U. S. A., calculates that a 10-inch accelerating gun would be as efficient as the 81 ton (16-inch) Armstrong gun, and nearly as efficient as the 100-ton (17-inch) Armstrong, while the latter would be surpassed in inefficiency by a 12-inch Lyman-Haskell gun. In the matter of cost and the expedition with which guns of a required penetration could be furnished the advantage seems to be as markedly on the side of the multicharge guns.

A still further advantage is promised by the new system in the relatively smaller cost of mounting, whether on land or water. The cost of a Duilio, carrying a 100-ton gun—the most powerful vessel afloat—would suffice for the building and arming of several small swift steamers armed with cheaper and lighter but equally efficient accelerating guns, while the larger craft would present a much better mark to hit than her smaller adversaries. In like manner a few properly mounted accelerating guns of ten or twelve miles range, commanding any of our harbors, would make them practically inaccessible to the most powerful war ships that could be floated.

In the SCIENTIFIC AMERICAN, of November 12, 1881, was described the casting of a 6-inch Lyman and Haskell gun at the foundry of the Reading Iron Company. The gun will be finished next spring. It will be twenty-five feet long, and will throw a shot weighing 150 pounds, with a total charge of 130 pounds of powder, or more than four times the weight of powder used with a shot of the same weight in the best guns now in use. A longitudinal section of this gun, showing the supplementary powder pockets, appears in Fig. 2.

The gun will be loaded with 18 pounds of hexagonal powder in the breech, and 28 pounds of finer powder in each of the pockets. The breech charge is intended to overcome the inertia of the ball without straining the gun. As the ball passes the openings to the several pockets the heated gases fire the supplementary charges, increasing the velocity of the projectile to 4,000 feet a second when it leaves the muzzle of the gun, or more than double the velocity attainable by guns of ordinary construction, a velocity sufficient, it is calculated, to carry the projectile twelve miles, or to enable it to penetrate two feet of wrought iron at a distance of 200 yards. The explosion takes place in tough steel backed by strong cast iron. The manner of charging the breech chamber and the several pockets is shown in the smaller cuts.

Touching the practicability of the methods of loading and firing guns on this principle, as developed by Messrs. Lyman & Haskell, we have the testimony of General Newton to the effect that no doubts are entertained by experts that the gas check can be made perfectly efficient, while, in his opinion, the loading of the pockets can be made as expeditious as the loading of the breech.

The contractors for the construction of the gun we have illustrated are Messrs. Pancoast & Tarr, agents in this city for the Reading Iron Company.

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Correspondence.

Goats to Protect Sheep.

To the Editor of the Scientific American:

Page 16 of your issue of January 14 contains an extract from the New York *Sun*, advising the public that the farmers of portions of New Jersey protect their sheep with goats. It is to be hoped, for the sheep's sake, that no farmers outside of New Jersey will ever follow their example. I once owned a beautiful Angora buck and ewe, and as he was the "best man" in the neighborhood, I trained the pair to range with my sheep for the latter's protection. This buck could jump any fence in the county, and could climb any tree growing in the corner of a rail fence by first getting on the fence and then into the tree. In quite a short time every wether I had was as good a jumper as the Angora buck, and had I not converted them into mutton I would have had a valuable flock of sheep ruined. Kill the dogs, but keep the sheep and goats separate here as well as hereafter.

D. W. A.

Washington, D. C., January, 1882.

The Question to Mr. Lawson Answered.

To the Editor of the Scientific American

In No. 1, vol. xlvi., SCIENTIFIC AMERICAN, your correspondent, E. H. Rood, states that a locomotive, usually carrying 80 to 100 pounds steam, "was going through the woods on a roadway built for logging purposes, and ran under a leaning tree which had fallen since the last trip before made, and the smokestack, safety valve, etc , were knocked clean off. The water spouted forty feet in the air, and the boiler was emptied in short order, but there was no explosion. Now, if the water explosion theory is correct, why was not there an explosion in this case?"

The danger of explosion does not arise from suddenly opening the valve, but from the *instant check to the bursting water by quickly closing it.* In this case the valve was opened without any danger of closing by a slight relief of pressure. It was opened "to stay." If Mr. Rood will carefully read the account of my experimental explosion as published in No. 313, SCIENTIFIC AMERICAN SUPPLEMENT, he will see what is claimed by what he terms the "water explosion" theory.

D. T. LAWSON.

Wellsville, O., 1882.

Attention, Inventors.

To the Editor of the Scientific American:

I beg leave through your columns to call the attention of inventors to a much-needed machine. It is well known that the settlers on the great Western prairies suffer great inconvenience on account of the scarcity of fuel, and yet have all the elements of an excellent fuel in the immense quantity of prairie grass about them on every hand. A simple machine that will spin prairie hay into hard solid knots or rolls of suitable size for fuel would certainly meet with a great demand. Prairie hay is now largely used for fuel by being twisted into knots by hand. This is slow work, besides it can be done much better by means of, say, a small foot-power machine. Inventors, try your hands.

C. F. H.

A Miner's Ingenuity.

James McGlynn, a miner in the Hallenback Colliery, at Wilkesbarre, Pa., has found recreation and amusement during the spare time of the past nine years in the construction of an elaborate clock. As described by a reporter of the New York *Times*, the clock stands about nine feet high, and is incased in an elaborately carved case of black walnut, consisting of 406 pieces of perfect finish. Each of these pieces was turned in the mine by the enthusiastic miner with a tool that would make a cabinet-maker smile, being nothing less than a broken saw file.

In addition to the 400 turned pieces in black walnut, which comprise the framework of the clock, it has 63 moving figures, actuated by machinery, so deftly arranged as to produce interesting historical and biblical scenes. It is the intention of the miner-mechanic to make the number of figures a hundred as soon as his means, which are rather limited, shall afford such an additional outlay.

The front of the clock shows three balconies, rising above a massive and elegantly carved pedestal, and upon these the moving figures appear. The lower balcony shows a procession of Continental soldiers, headed by a mounted general and marching past, while the old Liberty Bell proclaims its welcome notes of freedom. A sentinel salutes the Continentals as they pass, and just at the moment a door is opened from an upper balcony and reveals Molly Pitcher, with her cannon, which she fires with startling and realistic effect. To show how well the maker of the clock has considered the details of his handiwork, he has placed a small revolving fan in the clock, to be actuated after the firing of Molly's cannon, for the purpose of clearing out the powder smoke. Simultaneous with this the portraits of the twenty Presidents of the United States pass in panoramic view on a balcony just above the patriotic tableau, of which Molly Pitcher is the central figure, and Thomas Jefferson holds up the Declaration of Independence. The apostolic procession is similar to those hitherto seen in such clocks. The Twelve Apostles file past, Satan appears, and the cock crows in warning to Peter. A figure of justice raises her scales as the form of Christ appears, and during the scene a large representation of Death tells off the minutes upon a bell. When one sees the clock, the tools with which it was made, and hears the miner's story of how he bought the wood for it bit by bit as he could afford from his spare change, he is sensibly impressed with human possibilities. The figures used in the biblical and historical illustrations were cast by McGlynn in moulds of his own design, and there is very little in the entire clock that did not come from his hands. Now that it is finished he scarcely knows what to do with it.

Vegetation in Arctic Siberia.

Baron Nordenskjöld, in his account of the voyage of the Vega, gives glimpses of the vegetation found at the extreme north of the Asiatic continent. At the mouth of the Yenisei, for instance, as on all other Siberian rivers running from south to north, the western strand, wherever it is formed of loose, earthy layers, is also quite low and often marshy, while, on the other hand, the eastern strand consists of a steep bank, ten or twenty meters high, which north of the limit of trees is distributed in a remarkable way into pyramidal-pointed mounds. On the slopes of this steep bank and in several of the *tundra* valleys there is an exceedingly rich vegetation, which 100 kilometers south of Yefremo-Kamen forms actual thickets of flowering plants, while the *tundra* itself is overgrown with a scanty carpet, consisting more of mosses than of grasses. Willows of little height go as far north as Port Dickson (73° 30′ N.L.), the dwarf birch (*Betula nana*, L.) is met with, though only as a bush creeping along the ground, at Cape Schaitanskoj (72° 8′ N.L.); and in 1875, on the ice mixed soil of the *tundra*, ripe cloudberries were gathered. Very luxuriant alders (*Alnaster fruticosus*, Ledeb.) occur already at Mesenkin (71° 28′ N.L.), and the Briochov Islands (70° to 71° N.L.) are in several places covered with rich and luxuriant thickets of bushes.

But the limit of trees proper is considered to begin first at the great bend which the river makes in 69° 40′ N.L., a little north of Dudino. Here the hills are covered with a sort of wood consisting of half-withered, gray, moss-grown larches (*Larix sibirica*), which seldom reach a height of more than seven to ten meters, and which much less deserve the name of trees than the luxuriant alder bushes which grow nearly 2° further north. But some few miles south of this place, and still far north of the Arctic circle, the pine forest becomes tall. Here begins a veritable forest, the greatest the earth has to show, extending with little interruption from the Ural to the neighborhood of the Sea of Ochotsk, and from the fifty-eighth or fifty-ninth degree of latitude to far north of the Arctic circle, that is to say, about one thousand kilometers from north to south, and perhaps four times as much from east to west. It is a primeval forest of enormous extent, nearly untouched by the ax of the cultivator, but at many places devastated by extensive forest fires.

On the high eastern bank of the Yenisei the forest begins immediately at the river bank. It consists principally of pines; the cembra pine (*Pinus cembra*, L.), valued for its seeds, enormous larches, the nearly awl-formed Siberian pine (*Pinus sibirica*, Ledeb.), the fir (*Pinus obovata*, Turcz.), and scattered trees of the common pine (*Pinus sylvestris*, L.). Most of these already north of the Arctic circle reach a colossal size, but in such a case are often here, far from all forestry, gray and half dried up with age. Between the trees the ground is covered with a labyrinth of fallen branches and stems. Nearly everywhere the fallen stems are covered, often concealed, by a luxuriant bed of mosses, while tree lichens, probably in consequence of the dry inland climate of Siberia, occur sparingly. The pines, therefore, want the shaggy covering common in Sweden, and the bark of the birches which are seen here and there among the pines is distinguished by an uncommon blinding whiteness.

Cement-Beton and Artificial Stone.

At an assembly of German cement makers, Von Froideville made a report, which was published in the *Thonindustrie Zeitung*, in which he said:

A good cement does not crack, and even in a northern climate is able to resist the weather, supposing it has been properly mixed. If too much water has been used, so that a glassy crust forms on the surface, and the whole mass is not homogeneous, the cement checks or cracks, and as soon as hair cracks appear moisture enters and the frost completely destroys it. A second fault is when the cement strikes out, which it ought not to do. Cement can be colored nicely and permanently with suitable colors, but quite a good deal of color is necessary if it is required to entirely hide the natural color of the cement and give it the exact color desired. The addition of a coloring to cement makes it more friable and softer, so that it takes comparatively more cement than without the color. Cement is only just coming to be understood in practice, but, on the other hand, architects are too distrustful of artificial stone.

For several years artificial stone for curbstones and street gutters have been made at Potsdam, and have lasted well. The gutter stones are very cleanly and neat, and the fear that frost and the pressure of the earth on both sides would destroy them have proven unfounded.

Granite, when broken up fine, imparts to cement a very considerable strength similar to gravel, but the pieces of stone being heavier settle and interfere with its manufacture. On the other hand, the addition of granite to cement without any sand makes an excellent material. In the gymnasium at Potsdam are two pillars made in this way, which support not only a cross-vaulted arch, but also bear the pillars that extend to the upper story.

When marble is combined with cement without the addition of any sand, blocks are obtained of such strength that they are capable of receiving a fine polish, but cement must first assume the strength of stone. The problem was presented of building a stairs with steps 40 inches long, set into the masonry 8 inches at one end, each step having a height of 6½ inches, and a total width of 14½ inches. Experimental blocks were prepared, and at the end of six weeks four steps were put up for trial. Railroad iron was piled up on the steps, and the weight gradually increased until it reached 5,940 pounds. The steps held out, but no more could be put on because the masonry began to yield. The load was left on the steps for three days and nights without any injury. The steps subsequently remained unaffected. By adding pieces of marble to the cement different kinds of stone were imitated, with a saving of expense equal to nearly one-half the cost of real granite work.

A considerable quantity of cement is used for the flooring of terrace work. The manufacture of old Roman marble mosaics for parquettes and floors has rested many centuries, and has only recently been revived. The Italians make a ground bed or beton strata from puzzolana, or hydraulic lime, and pieces of brick, and lay the mass also in brick dust. Portland cement answers much better than these for joining the pieces of marble and such like, and can also be employed for mosaic plates and tiles.

Cement-beton—coarse gravel with cement below, fine sand with cement on top—is a pleasant and durable material used more and more every year for sidewalks and such like purposes. But many other things have been made of it—building objects, floor and cellar coverings, vaults, cattle cribs, stables, and even whole houses, as well as a series of bridges, that are both good and cheap.

At the meeting referred to, where this report was made, one firm in Amœneburg, near Bilbrich, exhibited photographs of a bridge which they had made for the Dusseldorf exhibition, while a Frankfort firm showed the plans and pictures of another beton bridge, also at Dusseldorf. It was planned by Loehr, and the arch had a breadth of 73 feet and a spring of only 71 inches. The thickness of the arch at the counterfort was 14 inches, and 18 inches at the top. The arch was constructed after the counterfort was done, April 14, 1881, by four cement workers and twenty hod carriers and helpers in *eight hours.* It was tested May 25 by a one-sided load on half the arch of 400 kilos per square meter, or about 80 pounds per square foot, without injury. It was then thrown open to the public, and was in use during the whole time of the exhibition.

Another firm had erected two large two-story farmhouses in Lauenburg, each 166 feet long and 76 feet wide, with an average height of 25 feet, all of beton. The walls were 8 inches thick on the first floor, strengthened every 10 or 15 feet with an extra thickness of 4 inches more, while the second floor had walls of only about 7 inches in thickness. The mixture employed consisted of 1 part of cement, 2 parts of sand, and 6 parts of gravel. The work occupied two months.

Buildings of a similar sort have been in use for some time in our own country, but have not met with much favor as a rule, notwithstanding their cheapness. Perhaps improved materials and more care in mixing, as well as in construction, may raise beton to the dignity of brick in sections where large stones are scarce. The latter condition is wanting hereabouts.

Comedones.

The black points, fleshworms, or comedones, which are found in the face, and especially near the nostrils, are not at all produced by the accumulation of the particles of dirt or dust, as has generally been believed, but by pigmentary matter which is soluble in acids. It is known, in fact, that black comedones which accompany acne often appear not only on persons exposed to dust or rather careless of their person, but also on chlorotic young girls who live in good circumstances. Besides, observation shows that the discoloration not only exists on the surface of old comedones, but descends always to the lower parts. Accepting this fact, Unna has used successfully acids in the treatment of comedones. He generally prescribes: Kaolin, 4 parts; glycerine, 3 parts; acetic acid, 2 parts, with or with the addition of a small quantity of some ethereal oil. With this pomade he covers the parts affected in the evening, and if need be during the day, After several days all the comedones can be easily expressed, most of them even come out by washing the parts with pumicestone soap. The same results can be obtained by bandaging the parts affected for a long time with vinegar, lemon juice, or diluted hydrochloric acid.

The author concludes by saying that the acids act like cosmetics, as they transform the black color into a brown and yellow shade and destroy it gradually altogether; they produce a quicker desquamation of the horny bed which interrupts the exit of the comedones and brings to the surface the glandular openings.—*Archives de Virchow.*

Photography of Gas Flames.

Gas fitters have recently made a most useful application of photography. They photograph the gas flames given by different burners or jets, so that a customer can see if the shape and form of a light will suit him before he gives his order. As the flames are, moreover, depicted "life-size," the purchaser can always tell whether his jet is up to the standard.

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The Sawmill Changes of a Century.

Among the most marvelous of the many wonderful things which distinguish the United States from other nations, are the results which have grown out of the possessions of immense forests of valuable timber, in stimulating inventive genius to the preparation of an article of building material so cheap as to enable the poorest to have a comfortable home, while at the same time so excellent in character as to be not only suited, but indispensable, to the working classes. Those more readily accessible regions of the continent which possessed these forest growths in the greatest abundance were among the first to receive large accessions to their population, drawn together at those centers which presented the easiest access to cheap building material, not less than for their personal safety from a savage foe. It was not until the demand for lumber far exceeded the ability of the "greatest" mills of half a century ago to supply, leading the manufacturers to feel the need of a more extended system of production, that the star of empire made any progress westward, or it became a possibility to settle upon the prairies of the West, or to develop the mineral resources which have already shown our nation to be the peer of, if it does not excel, all others in the extent of its possessions. To possess is to need. And the cheap building material which the cheap mills of the days long gone by enabled a scanty population to utilize, stimulated a more extended immigration, with its increased needs, as well as a higher order of inventive genius to increase the supply.

The mills of the olden time were, first, the windmill, with its uncertain power, scarce exceeding that of the men who ran the pit saws which were then in a measure superseded, and whose indignation at the effort to lessen their manual labor caused them to mob the owner and tear down his machinery. Second, the adaptation of a current water-wheel of scarcely greater power, if more reliable, run by the natural current of a small stream. Next came the simple flutter-wheel, to impart motion to which required the building of dams to hold large bodies of water, which should at all times be available. But for large operations the flutter-wheel was found to possess too little power, and the overshot or undershot wheel became a necessity, to be superseded later by the adaptation of turbine-wheels, now so much in favor with mill owners who control water power. For the first fifty years of our national growth, as well as during the preceding portion of the world's history, none of the mills were equipped with anything more than a single upright saw working in a gate, and when another saw was added, as the inceptive idea of the gang, which quickly succeeded with its large number of saws, words could scarcely express the astonishment of all who saw the working of the bold innovation.

Up to this time, all the lumber which was manufactured had been edged upon the top of the log after it was turned down; an auxiliary saw was not thought of, for the buzz-saw, just beginning to be used, was considered a most dangerous piece of machinery. But the increased manufacture growing out of an increase in the power and an increase in the number of saws, led to the introduction of the small circular or "buzz" saw, which was at once found to nearly double the capacity of the mill. It is needless for us to enlarge upon the introduction of steam power in the sawmill, or to follow the original idea of an engine, 6 x 8 inches, attached to the lower end of the pitman or saw gate, through its successive stages of development and enlargement to the present time, when the Corliss, or Estes, or other well-known engines, of a power from ten to one hundred times greater capacity than was the original device, are by the thousand in number engaged in turning out lumber, each in one season aggregating a greater manufacture than were all the sawmills of the country combined at a period scarcely fifty years in the past.

The old gate saw was superseded by the mulay, with a reduction of friction equal to thirty or fifty per cent increase in cutting capacity. The mulay gave way to the circular, and with its introduction may be dated the commencement of an era which has been prolific of innovation, improvement, and advantage to the sawmill world. As the use of the circular became better understood, and men became expert in so dressing it as to make true lines and smooth surfaces, they found themselves able to produce more lumber in the rough than they could properly edge and prepare for market. The old edging-table could not keep up with the cut of the saw. This was remedied by the introduction of gang edgers, which no mill doing any considerable business could now dispense with. Now the work of the main saw could be safely increased, for the gang—or, as it was at first known, "double"—edger was abundantly able to keep pace with it, and while at first a capacity equal to 1,000 feet per hour was doubtfully claimed, later developments have shown in not a few instances an entire season's work at the rate of 6,000 feet per hour.

This increase in capacity called for a more speedy method of handling the logs on the carriage, and the lumber as it left the saw, and a multitude of inventive minds were concentrated on mill dogs, which should successfully take the place of the lever and pike, driven by a mallet, and the modern sawmill could not now be operated with the original method of dogging the log. The "nigger," for turning the log on the carriage, as well as rolling it on the skids, has superseded the cant-hook and muscular power formerly relied upon, while the lumber, as it leaves the saw, drops upon a system of live rollers, which does the work to much better advantage than it was formerly accomplished by a hard worked "off-bearer," who could not in these days by any possibility keep up with the work which would crowd upon him.

Plenty of lumber, cheaply manufactured and sold at reasonable prices, has enabled the settling up of a nation at the rate of nearly fifty per cent increase of population during each decade. This in turn has demanded a network of railroads, and carriage by them has not as yet been reduced to a science, which enables us to believe that rates have reached a minimum which they will realize in the future. The manufacturer of lumber, bearing this in mind, must reduce the weight of his product to the lowest possible point, and the trimmer became a prime necessity as an economizer, not less than for an advantage in an æsthetic point of view. And the old gang mill, from its original adaptation of two saws, hung in a cumbrous frame, upon monstrous posts which headed in a weigh beam, made from the largest stick of timber which the forests afforded, and footed in the mill foundations, shaking the structure and the surrounding country, and keeping the machinery about one-half the time in the repair shop from its everlasting jar, has been displaced by the neat, effective, and comparatively noiseless devices of more modern times, developing a sawing capacity of which the fondest anticipation of the original inventor of the idea had not the remotest conception. The heavy weigh-beams have disappeared, the monstrous wooden posts have given way to equally advantageous and strong but less cumbersome and more sightly iron supports, resting upon foundations independent of those which support the mill frame. The old, stiff, and full-of-friction gate has been superseded by oscillating slides, giving to the saws the same motion which the pit sawyer seeks to obtain in order to accomplish the most work with the least outlay of strength.

Time would fail us to trace out all the changes which a quarter of a century has developed in the sawmill. Should a Rip Van Winkle of the last century be suddenly awakened from his long sleep, still dreaming of the last act of dogging the log on his old-fashioned carriage, in the old mill, when he took long naps between the cuts, and esteemed a production of 1,000 feet per day something to brag of, and open his eyes on the floor of a modern mill of the smallest size, he would truly think that the world had turned upside down, and if he saw the army of men carrying off a quarter of a million feet of boards per day from the saws of some of the larger mills, he would not believe the evidence of his senses. All has changed; the water-wheel has given place to the steam engine; the single small cylinder boiler, to the monstrous tubular or flue in large batteries; the upright saws in a gate, to the mulay and the circular; the two-saw gang, to a forty-saw; the rag-wheel, to the steam feed, adding countless possibilities to the ability of the circular saw to cut up logs; the single buzz saw, to the double edger; the rough end lumber, to the well trimmed; the vast piles of worthless slabs, to a useful article of lath and pickets; and the final *débris*, in many localities, to usefulness in the manufacture of other commercial articles. The pioneer knew nothing of lath and shingle manufacture; live rolls had not entered his noddle; gang slab cutters would have been by him pronounced an invention of the devil to feed the flames of his insatiable furnace. Endless chains would have had no use in his mill economy; saw sharpeners and gummers would have had no value in his eyes, for he could cut all the lumber he expected to, and find plenty of time for dressing his saws by hand.

The modern sawmill is indeed full of improvements, down to the last device for sorting by machinery. The production in one day, by one saw, of more lumber than was accounted the work of a year in former times, is not only the result of the genius of invention such as marks the spirit of the age, but has rendered possible the remarkable development of the youngest in the sisterhood of nations, forming no unimportant factor in the influence of this country among the people of the earth. All hail to the modern sawmill, and the wise intelligence of nearly every man who is connected with it, either in the production of logs from the forests or the manufacture and sale of lumber, for each progressive step in the march of improvement has reduced the cost of manufacturing lumber, keeping pace with the inevitable increase in the cost of timber, due to the gradual decadence of the forests!—*Northwestern Lumberman.*

Shipping at San Francisco.

A correspondent of the *Tribune*, writing from San Francisco, under date of December 18, says: It is a fine sight to see the wheat fleet lying at anchor here, or taking on cargoes at the wharves. There are ninety vessels now in port. They are the finest specimens of naval architecture afloat, at least among sailing vessels, and are of many different types. The handsomest are undoubtedly the oak ships lately built in New England. These vessels have very tall and slender spars and long yards, graceful hulls, and a style that elicits admiration at sight. No handsomer vessels are ever seen here than such ships as the Samaria, the A. J. Fuller, the Harvey Mills, and their sisters from the down-east yards. The British iron clippers come next. They are very seldom of large size. They average about 1,100 tons register. Along with the great ships in port here there are seen many smaller ones of Pacific coast construction which are as well worth looking at as any. The Pacific coast lumber schooner is the most beautiful craft of its rig in the whole country. The builders have made the evolution of this craft a specialty. They are as a rule keel schooners. The fore foot is cut away under the water like that of a yacht. The fore body is long and sharp, and the after body short and full, but with hollow water lines. The stern is elliptical and broad, and the top-sides fall lower from amidships away off with a grace, seldom, if ever, seen in a schooner on the Atlantic coast, and not often matched in a yacht. These schooners are often loaded down until the water runs over the deck; but whether light or loaded they make remarkably fast trips. With all their speed, they have an astonishing amount of stability, and they cruise along the coast northwards, on the return voyages, for lumber, without a pound of ballast or freight in them, carrying every yard of canvas there is in their outfit. When vessels of this model are put into the wheat trade the famous clipper of the olden times will certainly be surpassed for beauty and possibly for speed. There are eight hundred vessels now owned in the district of San Francisco, and a majority of them are of this class and model.

NEW INVENTIONS.

An improvement in shoes, patented by Mr. Daniel B. Felter, of Newark, N. J., is designed to simplify the construction of single-sole or turn shoes provided with a spring. The invention consists in a single-sole or turn shoe made by sewing the upper to the front part of the sole and to the spring, and then turning the upper and nailing the rear part of the sole to the spring.

An improved invalid bedstead has been patented by Mr. Asahel J. Goodwin, of Brookline, Mass. The improvement relates to the devices used for raising and lowering the hinged sections of invalid bedsteads, and are designed to obtain great power by conveniently operated mechanism. The invention consists in a rack and pinion combined with a cam on which the hinged section is supported; also, in a pawl for retaining the parts in position against downward pressure.

Mr. Martin Hubbell, of Mount Kisco, N. Y., has patented a clevis with a longitudinal groove in the inner edge of its end slot, and with a series of notches, forming teeth, in the opposite edge, this clevis being pivoted in the ordinary manner to a plow beam. The extremity of the latter is provided with a series of vertical grooves. The clevis and the ring are placed in the desired position, and are locked in the same by means of a key fitting in the slot of the clevis.

Mr. George A. Ramseyer, of Dobbs Ferry, N. Y., has patented an improved piano stool. This invention relates to the mode of securing the elevating screw and guide to the seat, and has for its object to obtain a firm and durable connection and a saving in the expense of manufacture.

Mr. Magnus J. Palson, of Elizabeth, N. J., has patented an improved machine for dressing fish—that is, to remove the head, entrails, and backbone—thus preparing the fish for salting and packing it for shipment. The machine is provided with a jointed reciprocating plate, upon which the fish is placed, and is held firmly by spring clamps, which are opened automatically to receive the fish by a beveled fork, a heart plate, and two fixed converging bars, between which the head of the fish is held, so that it can be cut off by an automatically released spring knife, that is drawn upward by a chain attached to a pulley on the main driving shaft of the machine, this shaft being provided with two cranks extending in directly opposite directions, one of these cranks being connected by a suitable connecting rod with the sliding plate for receiving the fish, and the other opposite crank is connected in a like manner with a reciprocating frame sliding above and in opposite direction to the fish holding plate, which upper sliding frame is provided with knives and scoops, that adjust themselves automatically, according to the size of the fish, and rip open its belly, tear out the entrails and backbone, and cut the latter off at half its length, and also tear out the liver and throw it into a chute. The fish is seized by a hook attached to a sliding plate connected with the upper sliding knife frame, and pulled out from between the spring clamps upon an inclined chute, down which it slides.

In the treatment of gold and silver ores containing copper the object is to obtain a matte or regulus which shall contain all the valuable metals. It is, however, found that with the usual methods the slag contains a certain amount of gold and silver, which is lost. To obviate this loss, by insuring a more complete separation of the precious metals, Mr. Richard Pearce, of Denver, Col., has patented a process of smelting ores of gold and silver by precipitating the particles of gold and silver held in suspension after the smelting is completed by throwing upon the slag as soon as the charge is perfectly smelted fine powdered oxide of copper, then closing the furnace a short time before drawing the slag. The effect of this application is that a reaction takes place between the oxide of copper and particles of gold and silver, in whatever combination they may exist, and a rich heavy matte is formed, which descends and carries with it the precious metals.

A novel exhibiting-bracket for stuffed animals has been patented by Mr. James Hobson, of Ann Arbor, Mich. The invention consists of a wire twisted to form a slot, bent upwardly to form a projection, twisted downwardly to form a loop, and having one end passed into a name plate or block.

Mr. Charles E. Trask, of Hastings, Mich., has patented an improved electric clock, wherein the impulse is given alternately by two magnets and the movement controlled by a pendulum. The objects of the invention are to provide for ready and accurate adjustment, to obtain equal tension on the vibrating armatures, to simplify the circuit closing devices, and to obtain the required movement of the impulse lever by a limited movement of the armatures.

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Mr. Thomas Trebell, of Limehouse, County of Middlesex, England, has patented a paint for ships' bottoms and other submerged structures, consisting of rosin oil, black lead, French chalk, white zinc, oxide of iron, and tallow, mixed with turpentine, linseed oil, rosin, Gallipoli oil, tallow, shellac dissolved in alcohol, Venetian red, red lead, zinc paint, and tar spirit.

An improvement in the class of police nippers which are employed for seizing and holding the wrists or arms of prisoners, and the curved jaws of which are so connected that the movement of one of them in opening or closing it will cause a like movement of the other, has been patented by Mr. John B. Craig, of St. Louis, Mo.

HORIZONTAL STEAM ENGINE WITH AUTOMATIC SLIDE VALVE CUT-OFF.

In the construction of steam engines, the progress of improvement has been steady rather than remarkable; for, since the steam engine left the hands of James Watt, who invented separate condensation, expansion, steam jacketing, superheating, and the governor, it has advanced principally by improvement in details and construction, and not so much by the development of new principles. At the present time there are certain excellences sought after by nearly every builder of steam engines, namely, economy of fuel, regularity of speed, simplicity of construction, durability, and freedom from derangement, the greatest power with a given size of cylinder and pressure of steam, and, lastly, elegance of design and finish. In stationary engines we find an infinite variety of construction—some of unsymmetrical form, roughly constructed, with slight finish; and, again, others having every improvement that is considered really such by the designer, with elaborate finish, and beautiful but simple mechanism.

As an illustration of the latter class, the horizontal engine, with an automatic slide valve cut-off, constructed by Mr. Robert Whitehill, of Newburg, N. Y., may be considered an excellent one. By the accompanying engraving it will be seen that the general appearance of this engine is attractive in design, correct in proportions, and compact. But among its best features is the simple and positive automatic slide valve cut-off, which can be adapted to any plain slide valve engine with excellent results. From direct experiment it has been proved that with the use of this valve an increase of twenty per cent of power is gained, and a more perfect regularity of speed is secured.

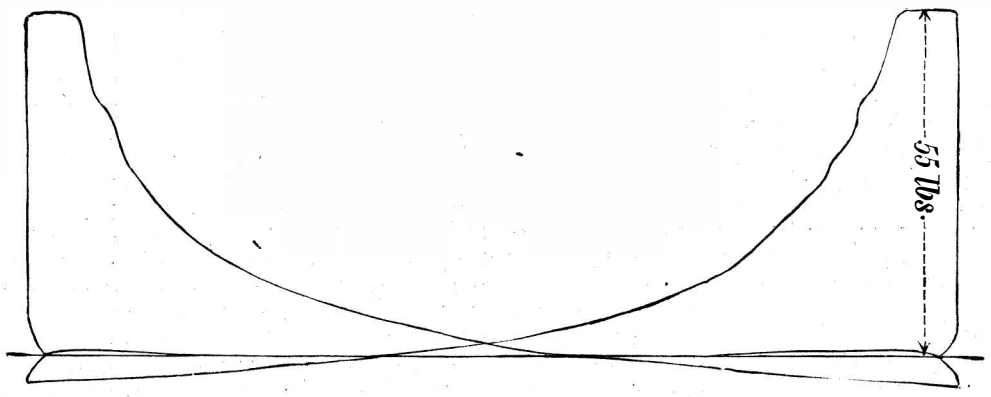
This engine has three valves—the main valve, the cut-off valve, and the "grid" or governor valve. The main valve is the same as usually employed, and regulates the admission and exhaust. It can be adjusted independently of the cut-off valve. The "cut-off," or intermediate valve, slides on the back of the main valve, and is provided with a number of ports which are controlled by the governor valve.

The main and intermediate valves are driven by eccentric, in the usual manner, the intermediate having a motion coincident with the piston.

The cut-off valves are attached to the governor in such a manner that the governor, in rising by reason of an increase of speed, thrusts the valves apart and effects a cut-off or closure of the steam ports in the intermediate valve at an earlier period of the stroke. If the speed of the governor is decreased the cut-off valves are brought closer together and steam is admitted to the piston for a longer portion of the stroke. The range of the cut-off is from the closest point to full stroke, therefore when the engine is at a standstill the cut-off is out of action entirely, and the engine can be started at almost any point of the stroke.

Above is given a certified copy of an indicator card taken from a 16 x 36 engine, fitted with this cut-off, at the American Institute Fair, and is a proof of the efficiency of the mechanism.

For further information address the builder, as above, at Newburg, N. Y., or at 142 Greenwich street, New York.



INDICATOR CARD TAKEN FROM A 16x36 ENGINE.

MECHANICAL INVENTIONS.

Mr. Atley W. Ale, of Caro, Mich., has patented an improved door and sash clamp for clamping tables or benches for holding doors and sashes during the process of manufacture. The invention consists in a novel combination of levers and locking devices, whereby the door or sash can be clamped equally upon all sides and at one operation.

An improvement in mechanical movements has been patented by Mr. Peter Broadbooks, of Batavia, N. Y. The object of this invention is to provide mechanical movements which, in their operation, shall exert great force of compression in the performance of any kind of work. The invention, which has its principal application to punching and shearing machinery, consists in supporting a roller provided with a pin or axle on one end between a reciprocating plunger and a cam lever, so that the pin shall move in an inclined or curved mortise in the frame of the machine, and gradually nearer to a right line with the fulcrum of the lever, and the point of contact of the roller with the reciprocating head or tool holder, to increase the compression as the operating tools are doing their work, and in so combining the frame of a machine which supports its operative parts with an upright post or standard that the compressive force exerted by the operating parts shall be increased by the addition of the entire weight of the frame and operating parts.

Mr. Elmer P. Newman, of Dimondale, Mich., has patented a metallic hub for vehicles having such construction that all escape of oil from the outer end of the axle is prevented, the hub being of cheap and simplified construction and adapted to be held upon the axle by a nut and collar fitted upon the axle at the rear end of the hub.

An improvement in pipe tongs has been patented by Mr. Deloss Worden, of Oil City, Pa. This invention is an improvement upon the improved pipe tongs shown and described in Letters Patent No. 240,067, granted to the same inventor April 12, 1881; and it has for its object to provide improved means for holding the bite-block in the bite-chamber, such construction as to the relative size of the bite-block and bite-chamber that the durability of the block is increased, and such construction of the bite-tong and its chamber that any length of bite-block may be used for increasing the bearing surface of the bite-block upon the pipe, and thus removing all danger of crushing the pipe.

An improved mode of setting saw teeth by means of rotating wheels provided with projections for engagement with the teeth of the saw, has been patented by Mr. Emanuel Larson, of South Pueblo, Col. When the machine is properly adjusted the setting of a saw is simply a matter of rolling it through the machine.

Mr. George F. Sawyer, of Liberty, Texas, has patented an improvement in bench planes. The object of this invention is to prevent dulling the cutting edge of a plane iron by the backward movements of the plane. The improvement consists in a stirrup pivoted to the sides of the plane in such a manner that the transverse piece of the stirrup passes through a transverse groove in the under surface of the plane, this groove increasing in height toward the rear of the plane, so that when the plane is drawn backward it will be slightly raised by this stirrup, so that the cutting edge of the plane iron cannot slide on the board being planed.

The Shaw Locomotive.

The Hinkley Locomotive Works of Boston, Mass., have lately built a locomotive after the designs of Henry F. Shaw, of Roxbury, Mass., intended to obviate those strains on the frame of the ordinary locomotive that are caused by the alternating thrusts of the unbalanced moving parts on each side of the machine. The impulse of the change of direction of the heavy side of wheel, etc., is in a "fore-and-aft" direction on one side of the engine, while it is vertical, either upward or downward, as the case may be, on the other side at the same instant, the former tending to rack the frame and the later cause lateral oscillations, which it actually does, more or less, to the great damage of the road bed. The effect is far greater if the engine is rocking from side to side than what would be due to the simple impulse of the preponderating weight of the reciprocating and revolving parts. The plan of the Shaw locomotive is to place a duplicate set of revolving and reciprocating parts on either side of the engine, so connected that one set on each side will be thrusting in the same direction at the same instant, and thus tend to correct this hitherto unavoidable objection to outside cylinder locomotives.

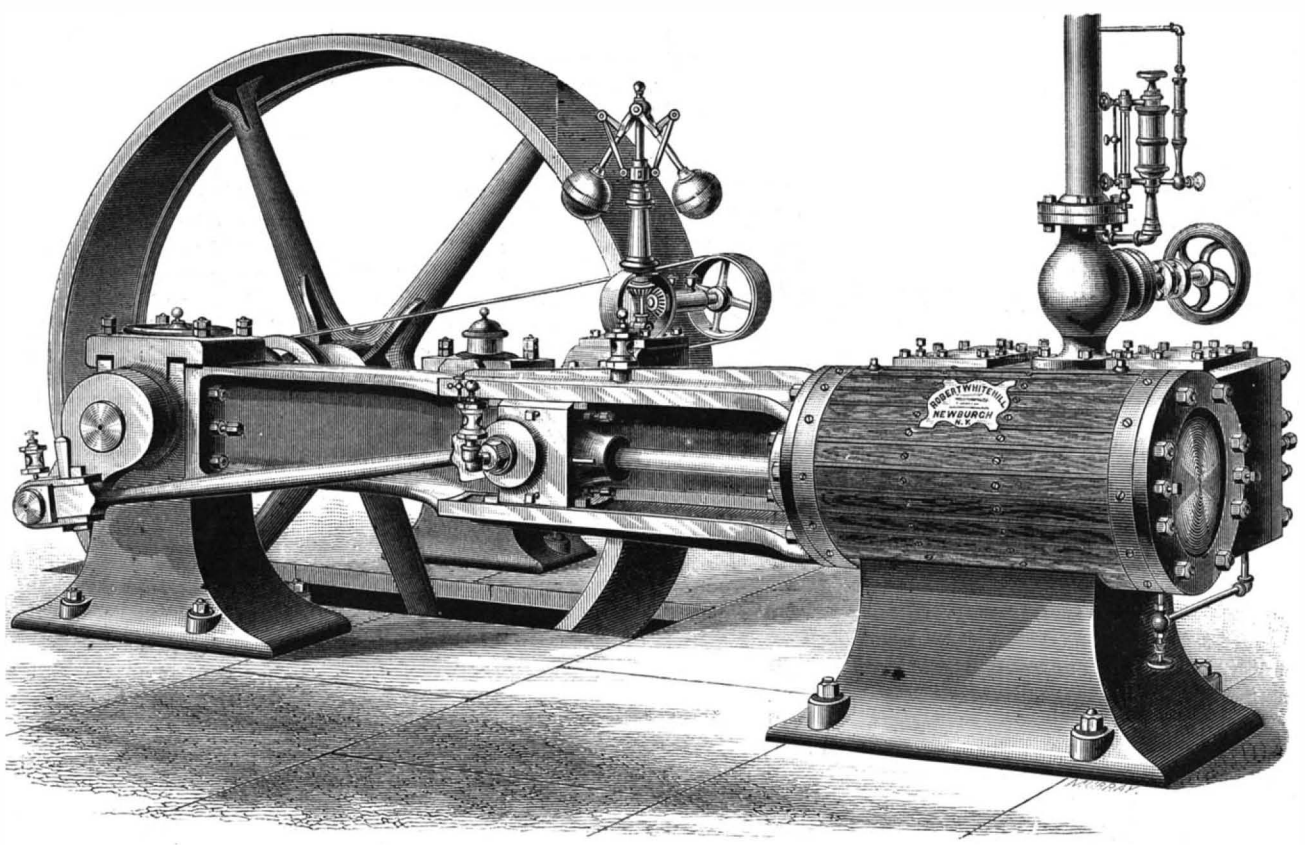
A trial trip was recently made with this new machine on the Camden and Atlantic railroad. The Philadelphia *Inquirer* gives the following as the dimensions of the four cylinders, etc.: They are "10½ inches in diameter, 24 inches stroke, equal to a 14⅞ x 24 of the ordinary locomotive. The cylinders are placed side by side in the same place. Four cylinders are contained within two castings, and do not increase the width of the locomotive as much as might at first be supposed.

"One slide valve admits and exhausts steam to and from each pair of cylinders, which are placed side by side; the valves are operated by the usual link motion and rock arm (as is customary upon ordinary locomotives), thus avoiding the complication that would arise from the use of a separate slide valve for each cylinder. This engine, when running, cannot be distinguished from the ordinary locomotive having only two cylinders, as the steam is taken and exhausted from the opposite ends of two cylinders simultaneously.

"Many experiments have been made in balancing, reciprocating with rotating parts to run steadily with each other, on locomotive engines, as they are now built, involving some of the finest mechanical calculation; but all of them have been unsuccessful.

"This locomotive is built for fast running, and it is claimed that there is an increase in the area of wearing surfaces, perfect balancing of the revolving parts, due to dividing the work between four steam cylinders. One of the remarkable tests that have been applied to this locomotive is to place it on four jack screws and elevate it clear of the track, and then to open the throttle valve and run the engine at a speed of two hundred and seventy-five revolutions per minute in this position without disturbing it, while an ordinary locomotive in this position would be disturbed at three revolutions per minute.

"The time made between Camden and Atlantic was seventy-seven minutes, which included two stoppages of six



HORIZONTAL ENGINE CONSTRUCTED BY ROBERT WHITEHILL, NEWBURG, N. Y.

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minutes at Egg Harbor and Absecon, the actual running time being seventy-one minutes. The fastest mile was made in fifty-eight seconds, and two consecutive miles, each fifty-nine seconds, three cars on the train."

IMPROVED ICE MACHINE.

We give an engraving of a new machine for manufacturing ice on a commercial scale, which possesses many points of novelty and interest. It is the invention of Mr. D. L. Holden, of Philadelphia, the well-known inventor of ice machinery. The cooling agent employed in this machine is ammonia, which is manipulated in much the same way as is usual in this class of machines; but there are several improvements on pumps, valves, etc., which add greatly to the perfection and efficiency of the machine.

The freezing, as will be observed by reference to the engraving, takes place in a chamber, A, thoroughly protected against external heat and provided with a hollow central shaft, D, arranged to receive the non-congealable liquid from above and the water to be frozen from below.

Around this central shaft, and some distance from it, there are two concentric metal walls, C, resting in a circular trough, F, for receiving the non-congealable liquid, and in the center of the space between the plates, C, there are vertical pipes, V, in which the liquid ammonia is expanded into gas. Above these pipes, and in communication with the upper portion of the hollow central shaft by a pipe, H, there are two rose nozzles which receive a supply of the non-congealable liquid from the trough, F, through the pipes, G, I, the circulation being maintained by the pump, O.

The water to be frozen is forced by a pump, P, through the lower portion of the hollow shaft, D, and through the nozzles carried by the tubular arm, G. The water is directed in a stream against the circular wall plates, C, upon which it freezes and forms the foundation of the solid coating of ice that gradually forms within and outside of the walls, C.

When the cylinders of ice have acquired the desired thickness they are sawed up into rings by the circular saws which are carried by the shafts, *i i*; one set of saws being arranged for the inner cylinder of ice and another set for the outer cylinder.

The ice is loosened from the circular walls by temporarily elevating the temperature of the non-congealable liquid sufficiently to detach it. The ice is then cut into cubes and discharged through chutes in the bottom of the chamber.

In starting the machine the aqua ammonia is warmed in the still, W^1, and drawn through the dehydrator, W^2, and drier, W^3, by the pump, R, and forced through the cooling coils, L, where it is condensed, and from which it is conveyed to the reservoir, Q, in a liquid form.

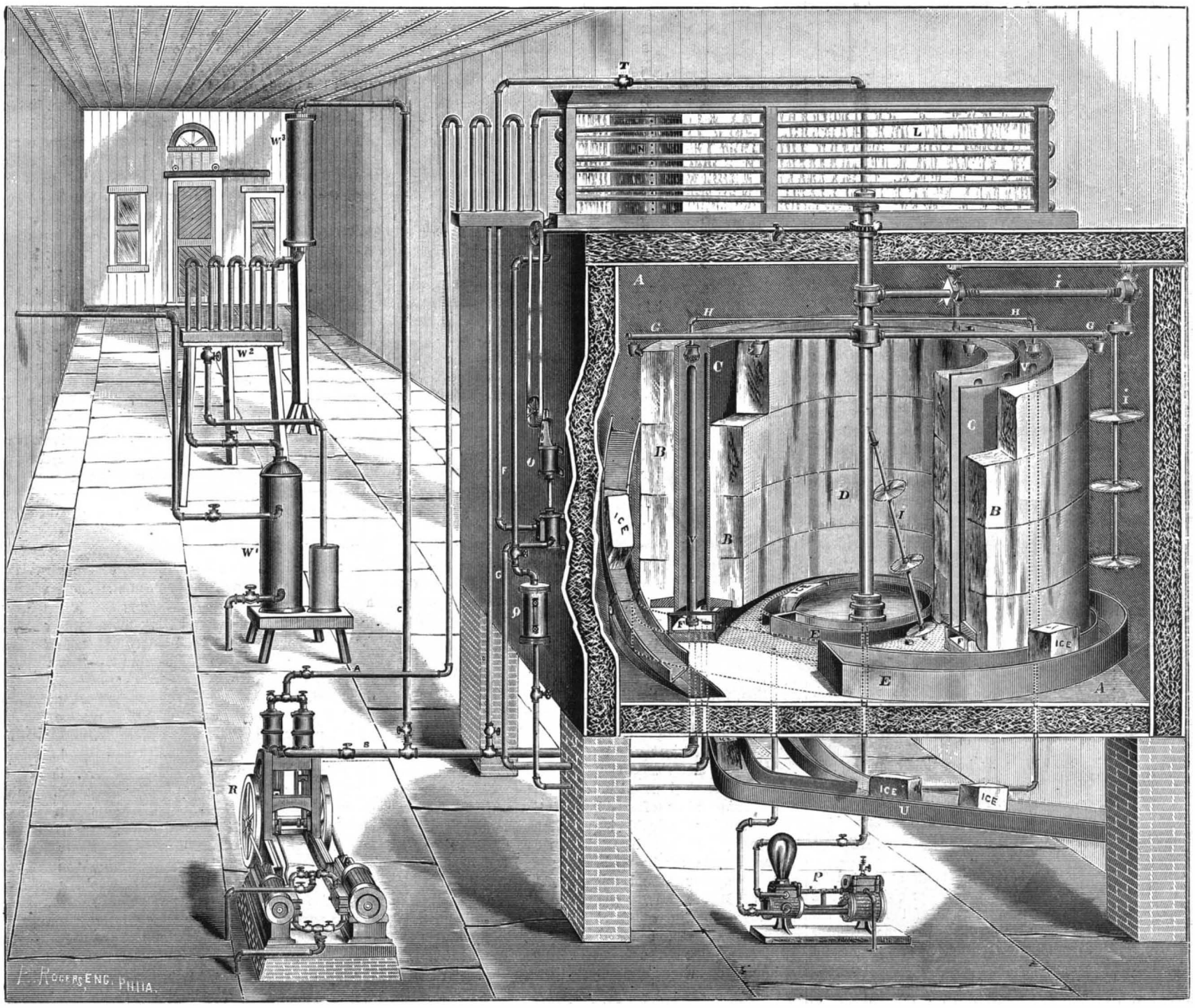
After this reservoir is once filled the valves of the pipes leading to the pumps are changed so that the cycle is from the pipes, V, in which the liquid ammonia is expanded into gas, to the pump, thence to the coolers, L, thence back to the reservoir, Q.

This machine is continuous in its action, and easy to manage.

The engines and pumps used in this machine are duplex, and so arranged that either pump or engine can be stopped and the other continue to work. The pump pistons are converted into valves, and are as automatic as a slide valve. This is an important feature that will be appreciated by users of pneumatic pumps. The improvement in valves, connections, etc., is of great value, making them, as we are informed, absolutely ammonia tight.

Perhaps the greatest improvement is the method by which the water is frozen, insuring perfect clearness and great rapidity in making the ice. The uncongealable fluid performs a double function; first, it conducts the heat from the water to be frozen through the iron plates; it refrigerates the room down to a low degree of temperature, and by this means causes surface freezing, thus permitting of freezing ice twelve inches thick in twenty-four hours, whereas by the old system of conduction alone it required from six to eight days.

The water flows in a stream upon the freezing surface in sufficient quantities to allow a surplus to run down and fall in the tank or pan beneath, washing off all air bubbles and other foreign substance, leaving the ice perfectly transparent and as hard as Kennebec ice.



HOLDEN'S NEW ICE MACHINE.

ENGINEERING INVENTIONS.

A machine by which cuts on railroads can be cleared of snow rapidly and without the labor of shoveling, has been patented by Mr. Wayne Choate, of Glenwood, Iowa. The invention consists, essentially, in oscillating boxes and movable end gates, by which the snow is first gathered and then dumped.

Mr. Gordon Land, of Alamosa, Col., has patented an improvement in water races in which the sand and all other sedimentary matters brought into it by the current of the water may be trapped off and prevented from passing through the head gates of the race. The invention consists in forming a trap in the bottom of the race which communicates with waste gates made in the side walls of the race.

A central unloading car, specially designed for dumping earth on railroads, has been patented by Mr. Joseph S. Halsey, of Lebanon, Ohio. The invention consists of a car having a platform constructed in longitudinal sections, pivoted at their ends within inclined slots made in the car sills in such a manner that when the platforms are elevated at their outer edges the weight of the load will cause their pivots to slide down the incline of the slots and depress the platforms at their inner edges, so that the load will be centrally dumped through an opening along the entire length of the platform.

An improvement in stamp mills has been patented by Mr. Frederick L. Preston, of Walworth County, Wis. The improvements relate to mills for crushing and pulverizing ores, and have for their object to furnish a simple, durable, and inexpensive mill. This mill consists of a V-shaped grating adapted to receive the angular face of a heavy hammer which crushes the ore as it is raised by wipers or friction rollers carried by the shaft of the machine.

An improvement in duplex steam engines has been patented by Mr. George Aab, of Brooklyn, N. Y. The invention consists in constructing a duplex steam engine with the piston rod of the one cylinder connected with the valve of the other cylinder by an arm, a connecting rod, and a crank arm, whereby the movement of the piston rod of each cylinder will shift the valve of the other cylinder.

Mr. John W. Thomason, of Salado, Texas, has patented an improvement in car couplings, which consists of certain devices whereby the coupling pin raised in the drawhead is supported until the drawheads strike each other in coupling, when the coupling pin falls by gravity. The invention also consists of devices whereby a link or pin may be raised separately or both raised simultaneously, as the case may require.

A novel rotary engine, patented by Mr. David O. Holman, of Adams, N. Y., consists in a new form of the cylinder and piston, and certain details connected therewith, whereby an engine is produced which will run with equal facility in both directions. It is what is practically two engines combined in one, which may be used either separately or both together.

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MISCELLANEOUS INVENTIONS.

A machine for sawing lumber or boards into certain standard lengths known in the trade, as, for example, "twelve-foot" lengths, "fourteen-foot" lengths, or lengths denominated by the number of feet, has been patented by Mr. Willard B. Swartwout, of Three Rivers, Mich. The invention consists in a novel arrangement of certain devices, whereby provision is made for automatically feeding the lumber to the saws and adjusting the saws so that they will cut the lumber in the desired lengths.

An improved flushing valve has been patented by Mr. David Thompson, of Leeds, County of York, England. This flushing valve is for use with water closets and at other places, combining simplicity and certainty of action in the supply of a definite and exact quantity of water each time the handle is lifted, whatever the extent, height, or time of lifting may be, and the prevention of any increased supply, however long the handle may be held up. The invention consists in the combination, with a valve, of a float and ratchet, whereby the closing movement of the valve is governed.

Mr. Charles M. Tyler, of Indianapolis, Ind., has patented a bill file constructed of a spring wire, having one or more ring-coils and one or more slotted elastic holders for paper fasteners, whereby bills and other papers can be securely held and readily fastened together.

An improved washing machine, patented by Mr. Harrison Anderson, of Eddyville, Iowa, consists of a tub, a skeleton cylinder pivoted in the tub to receive the clothes, and a beating mechanism to knock the clothes back into the water as they are raised by the revolution of the cylinder.

An improved mitering machine has been patented by Mr. Theodore E. King, of Westport, Conn. This invention consists of a pair of upright jaws for guiding the saw, which jaws are mounted on the extremity of a pivoted lever that is attached to the under side of a suitable bench or support, the construction being such that when the lever is moved laterally by the operator the guide jaws and saw will be correspondingly moved, so that the angle of the miter may be quickly changed, as desired.

A novel tool handle attachment has been patented by Mr. John L. Coleman, Jr., of Wattsborough, Va. The object of this invention is to provide an attachment for handles by means of which all farm tools, such as shovels, hoes, forks, and the like, may be attached to and used with the same handle. The invention consists of a slotted semi-cylindrical head, in combination with a diagonally-bored handle socket having a concaved end in which the semi-cylindrical head fits, the tools being provided with suitable shanks for engagement with a T-headed bolt or rod which passes through the slot in the head and the diagonal bore in the socket and receives a nut above a shoulder formed on the upper side of the socket, against which the nut comes for tightening and holding the tool securely.

An improved ankle support for skates has been patented by Mr. Ellwood G. Macomber, of Portsmouth, R. I. The invention consists in providing the forward edge of the heel plate of the skate with a socket, in which is secured the bent lower end of an upright rod, to the upper end of which is attached a divided leg band, one leaf or section of which is closed by the pressure of a spiral spring carried on the upright rod, the degree of pressure of the spring being made adjustable, as desired.

A safety snap hook which may be quickly and easily attached to a leather rein without the use of brads or thread, has been patented by Mr. Winfield S. Truitt, of Weston, Ky. The invention consists in two hooks combined in a peculiar manner, and provided with serrated clamping jaws for attaching it to a leather rein.

An improvement in portable fences has been patented by Mr. Joel Heacock, of Marlborough, O. The object of this invention is to improve the construction of the fence for which Letters Patent were granted to the same inventor January 18, 1881. The improvement makes it stronger and more durable.

Mr. Charles T. Wright, of Bodega, Cal., has patented an improved crank handle. The object of this invention is to facilitate the attachment of handles to hand wheels or cranks of machinery of any description, and to provide means for the lubrication of the internal parts of the handles, which are constructed to avoid blistering or otherwise injuring the hand of the operator. The invention consists of a handle hollowed longitudinally and containing a headed bolt, the shoulders of the head of said bolt acting against shoulders formed by an enlargement of the cavity in the handle, which enlarged cavity is closed by a screw plug or cap at the outer end of the handle, the inner end of the headed bolt carrying a jam nut and an outer nut, between which the crank is held, an oil chamber being also provided between the outer cap and the head of the bolt.

Mr. Sewell J. Cilley, of Gonic, N. H., has patented an improvement in belt pulleys, which consists in forming the periphery of the pulley with holes, passages, or ducts for the escape of air from between the belt and the pulley and to roughen the surface of the pulley to increase the frictional contact of the belt. The invention also consists in grooving or incising the periphery of the pulley from or near the center of the belt surface diagonally to the edges to decrease the tendency of the belt to run off from the pulley.

A drawbridge which can be readily operated, and will be equally balanced and self-sustained when partially or wholly opened in a manner to relieve the main bridge from lateral strain and rack, has been patented by Mr. Elias A. Wible, of Brighton, Cal. The invention consists in a double draw composed of two hinged sections operated simultaneously by cogged segments, also in a system of bracing whereby the weight is equally divided and balanced.

Malleable Cast Iron.

A recent number of the *Polytechnisches Notizblatt* contains the following brief description of malleable cast iron, its history, preparation, and properties:

The discovery that cast iron could be rendered malleable and tenacious by a subsequent withdrawal of the carbon, was made more than two centuries ago, but seems to have gradually sunk into oblivion and been forgotten. This seems almost incomprehensible in comparison with the great advantages offered by this material. When we contemplate with what difficulty wrought iron can be shaped and converted into complicate forms, and, on the other hand, how almost absolutely useless cast iron is for parts of machinery, owing to its being so brittle, we might have supposed that the discovery of a material in which should be united the advantages of both without possessing their disadvantages, would mark a new era in mechanics. Nevertheless the discovery had been in so far forgotten that at the beginning of the present century it was patented anew in England, and from that date its production was slowly revived.

It is well known that the brittleness of cast iron is a result of the high percentage of carbon that it contains, and which at the same time renders it fusible. The small quantity of carbon in wrought iron causes it to be very tenacious and tough, but unfortunately injures or destroys its fusibility. The manufacture of malleable cast iron consists in removing a portion of the carbon from the finished article after it has been cast in the desired form. This is done in what is called a tempering furnace, where the casting is placed in contact with some substance rich in oxygen, and then heated to a red heat. The carbon of the iron unites with the liberated oxygen and escapes as carbonic oxide gas, and the result is a material poorer in carbon and consequently extraordinarily tough.

For the purpose of tempering the pieces of cast iron are put in a cast iron vessel on a layer of this oxidizing substance and the intervening spaces filled with the same. Among the substances employed for oxidizing the carbon are the oxide of zinc, brown and red hematite, and hammerslag or scales, the red hematite being the most frequently used. The duration of the process varies between twenty-four and ninety-six hours, depending first on the dimensions of the casting to be tempered, and, secondly, upon the degree of softening desired. The limits in this latter respect are very wide, since with proper mixtures of iron it is possible to absorb all the carbon, or all but a slight trace of it.

The proper choice of iron is difficult, since many kinds of iron, owing to the presence of other substances therein, are not fit for tempering. For example, the presence of a proportion of manganese will entirely prevent decarburation, hence what is known as spiegeleisen cannot be employed because of the manganese in it. The presence of much crystalline graphite (gray iron) is just as injurious in another direction, for either it will not burn at all or it causes hollow spaces and cavities within the casting. The best iron is one free from manganese and containing amorphous carbon as white cast iron. In this respect, however, views differ, and the manufacture of malleable castings depends chiefly on practical experience.

This tempered or softened iron, if the material was well selected, makes a valuable iron which is but slightly inferior in strength to wrought iron. It can easily be worked with files and chisels, can be readily polished, and at a dull red heat can be wrought and welded. At the Halle exposition held in 1881 there was, says a paper published there, an interesting collection of articles made from this material, which shows that it is capable of a great variety of uses.

It is stated that the surface of cast iron can be tempered by immersion in aqua regia diluted with water.

P. N.

Fireproof Paper and Ink.

According to a German paper a very promising success has been attained recently in the manufacture of fireproof paper and ink. In making the paper ninety-five parts of asbestos was used with five parts of wood fiber; these, by aid of glue water and borax, were made into a pulp, which yielded a fine, smooth paper which could be used for writing purposes. It had the unusual quality of sustaining the influence of a white heat without injury. Fireproof printing and writing inks were made by combining platinum chloride, oil of lavender, and lampblack and varnish. These ingredients produced a printing ink, and when a writing fluid was wanted, Chinese or India ink and gum arabic were added to the mixture. Ten parts of the dry platinum chloride, 25 parts of the oil of lavender, and 30 of varnish are reported by a local writer to yield a good printing ink of this valuable kind when mixed with a small quantity of lampblack and varnish. When the paper printed with the compound is ignited the platinum salt is reduced to a metallic state and becomes a coating of a brownish black color. A free flowing ink for writing on the fireproof paper with an ordinary metallic pen may be obtained, says the same authority, by using 5 parts of the dry chloride of platinum with 15 parts of oil of lavender, 15 parts of Chinese ink, and 1 part of gum arabic, adding thereto 64 parts of water. When the paper is ignited after being written upon with this ink, the platinum ingredient causes the writing to appear transparent, and, as a consequence, it is claimed that such writing as has become black or illegible will become readily legible again during the process of heating the paper. Colors for painting may also be made fireproof by mixing commercial metallic colors with the chloride of platinum and painter's varnish, adding an ordinary aquarelle pigment to strengthen the "covering power" of the color. These fireproof paints or colors can be easily used in the same manner as the common water colors, and it is claimed they will resist the destructive influence of great heat quite as successfully as the fireproof printing and writing inks just referred to.

Wool Sorters' Disease.

Mr. Spear has recently published his official report, which establishes the identity of the wool-sorters' disease with anthrax. The symptomatology and anatomy of this affection are fully discussed, and certain interesting observations are advanced in regard to its pathology. The usual classification of anthrax into an "external" and "internal" form is observed throughout the report. In many instances, however, there is a wide divergence from the development and progress of typical cases. The malignant pustule may appear, not as an initial lesion, but as a local manifestation of constitutional infection, and a "minor pustule" is apt to attack the hands of those working on infectious material, a pustule very different from the typical form, but closely resembling the lesion resulting from only partially successful inoculation of anthrax virus upon carnivorous animals, and similar to that produced by Pasteur's "attenuated virus" in the herbivora. In the other variety of the disease, the anthrax fever, still more important deviations from the accepted type are described, and although the German and French observers look upon the affection as almost always fatal, Mr. Spear concludes that only a moderate number of cases terminate unfavorably. Again, while one man may be stricken down by a rapidly fatal malady, his comrade, working in the same material, may also be affected, but by a form of the disease which stops short of the severer symptoms, and ultimately goes on to recovery.

The histories of long-continued malaise, also, among wool-sorters are numerous. The symptoms are much like those of the prodromal stage of acute infection—headache, depression, nausea, dimness of sight, cramps, restless sleep, with the occasional appearance of cutaneous eruptions, petechiæ, boils, or herpes. At times an apparent periodicity is observed in the subjective symptoms. Such manifestations may occasionally occur as prodromata of an acute attack of the disease; more often, however, they disappear spontaneously. The author admits the possibility of a chronic anthracoid poisoning, the analogue of which may be found in malarial disease. The operation of the virus from its very inception is peculiarly inconstant. Incubation may be deferred by long periods of latency; full development may be delayed by prolonged and intermittent prodromata; often the disease aborts. At first, and for a variable time, the virus is "barely able to prolong its existence;" either the removal of unknown obstacles, however, or the addition to the blood, or secretions, of agents promoting the development of the poison, or both these contingencies, enables the infectious material to exert its full sway, and the disease to run its fatal course. To explain the unequal receptivity to the poison, Mr. Spear revives an old theory, that of the eating of more or less crude vegetables and fruit. Guided by the well-known predilection of this contagium for herbivorous animals, and by the fact that flesh-fed rats prove refractory to inoculation with anthrax virus, while the same rats fed on vegetables quickly succumb, the author was led to inquire into the alimentation of the wool sorters who had suffered from acute attacks of anthrax fever. He found that in nearly every case in which information was obtainable, the development of urgent symptoms had supervened upon the ingestion of an unusual quantity of vegetable food in some form or other. Again, in several cases of remission of the symptoms, a relapse seemed to follow the eating of vegetable food. In Constantinople also, where the external form of the disease is well known, the eating of vegetables and fruit during an attack is regarded as "especially dangerous." The evidence appears to be strong and circumstantial so far as such evidence can be. The experiments of Feser are now very generally accepted by Continental authorities as indicating that the relative immunity of the carnivora is not inherent to the genus, but is influenced by the nature of their food. The immunity of the fœtus is now regarded as dependent on the fact that it is really a carnivorous animal, not on any filtering action of the placenta. As Mr. Spear says: "It is conceivable that alimentary substances may bring about in the body such chemical or morphological changes as will render its fluids a richer field for the proliferation of disease germs."—*British Medical Journal.*

A Project to Pipe Gas Two Hundred and Fifty Miles.

A company of well known capitalists have organized the "Gas Light Transportation Company," to mine coal and manufacture gas in Pennsylvania, and pipe the gas to Eastern cities. A director of the company recently said that they propose to erect gas works that will manufacture 40,000,000 feet of gas per day. This would require 1,460,000 tons of coal annually. The coal can be bought at the mines for 55 cents per ton, but the gas companies pay $4.62 per

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ton for it. They save something by the sale of coke, tar, and ammoniacal liquor, so that their coal costs them $3.14 per ton, or 32 cents a thousand cubic feet of gas manufactured. One great saving expected by the new company is in the cost of coal and in the transportation. Another saving will come, they think, from the freshness of the coal, since coal newly mined produces more and better gas than coal that has been exposed to the air and weather. The cost of pumping the gas is offset by the value of the coke. The deterioration of gas in the long pipe they expect to counterbalance by making the gas extra rich at first. The pipe is to be of iron, six feet in diameter, laid in hydraulic cement.

AGRICULTURAL INVENTIONS.

Mr. Sheldon B. Parker, of Groton, N. Y., has patented an improved potato digger, consisting of a carriage carrying a curved or angular bar provided with digging teeth and hinged at its ends adjustably to plates attached to the axle, the curved or angular bar provided with gathering teeth and hinged at its ends adjustably to the axle, and the two levers for regulating the pitch of the teeth, whereby the potatoes and the soil in which they are embedded are raised, and the potatoes are separated from the soil and collected along the center of the row.

An improved plow has been patented by Mr. Isaac V. Newsom, of Mount Meigs, Ala. The object of this invention is to facilitate the adjustment of plows and promote convenience in repairing them. The plow standard is made in two parts, or is slotted longitudinally, to receive the beam in its upper part and the plow fastening bolt in its lower part. The standard is hinged by a bolt, at or near its middle, to a metal block bolted to the lower side of the beam so that this standard can be adjusted to regulate the pitch of the plow.

An improved sulky plow has been patented by Mr. George Applegate, of Yoncalla, Oregon. The object of the invention is to provide means whereby the depth and width of the furrow cut by the plow may be easily regulated and the plow controlled while in motion, and to provide a plow of light construction and draught, and one which can be easily turned at the corners, and capable of such manipulation as to adapt it for plowing in indirect lines or curves.

An improved flax puller has been patented by Mr. Samuel W. Gaines, of Scio, Oregon. In using the machine, as it is moved forward the flax is clamped between reel bars and a padded drum, and is pulled by the reel and drum and deposited upon a platform whence it can be raked off by hand, or by an automatic mechanism connected with and driven from the driving parts of the machine.

The Geology of the Lake Region of New York.

At a recent meeting of the New York Academy of Sciences, Dr. Lawrence Johnson read an interesting paper on the "Parallel Drift-hills of Western New York." A glance at the topography of the western section of the State shows a series of long and narrow lakes, among which may be mentioned Skaneateles, Cayuga, and Seneca as perhaps the most important. These bodies of water vary from a few to one hundred miles in length, and are of extreme depth, considering their breadth, which is often not more than four or five miles, and at points even less. They lie in cup-shaped valleys between series of hills whose general direction is from north to south. They are connected by a stream of water called at different points Duck River, the Clyde, and so on, which finally turns the flank of the great limestone formation of the Niagara and empties into Lake Ontario. After minutely describing the surface of the section and noticing the extreme comparative depth of the lakes, varying from 400 to 600 feet, Dr. Johnson proceeded to consider the question of their formation, rejecting, for many reasons, the theory that they were excavated by icebergs. The section, embracing from 800 to 1,000 square miles, was one of great interest, the speaker said, because no such ranges of drift-hills had been elsewhere noticed on this continent, save possibly by Sir William Logan, who described a somewhat similar formation high up on the Ottawa River in Canada, whose ranges lay north and south in the same manner. Dr. Johnson advanced the hypothesis that the whole section he had described was once nearly covered with water, and there were evidences, as, for example, in the marshes north of Cayuga Lake, that they had formerly extended further northward. The tamarack tree grew in great abundance in these marshes on the north, and the nature of the strata beneath was such as to show that they were formerly parts of the bodies of water that they joined. It would be noticed by the listener that the long axes of the small lakes he had described, while pointing in the same general direction, all converged at such angles that they would meet, if continued on the map, in the great peninsula of Labrador, which was now believed to have been the mother of a vast prehistoric series of glaciers concerned in the formation and modification of the tract lying to the south and southwest. Lake Ontario was evidently formed by the same tremendous glacier that excavated the basin of Lake Erie.

Ceramoid.

Dr. R. Martin, of Sonneberg, in Thuringia, has invented a substance which is said to resemble matt porcelain biscuit and faience, and has the ring of ceramic products. The process employed by him consists in mixing the clay with water glass so that it hardens without the necessity of burning. The objects made of it, especially doll heads, key escutcheons, vases, etc., are made of clay, mixed with infusorial earth, cellulose, or fibrous substance, and either pressed in plaster moulds or made by pouring the thick paste into moulds, and then, after they are taken out of the mould, they are dipped in a solution of water glass. Owing to the capillarity of the substance mixed with the clay the water glass solution is rapidly absorbed by the substance and soon penetrates the entire mass, and when it hardens the mass resembles stone.

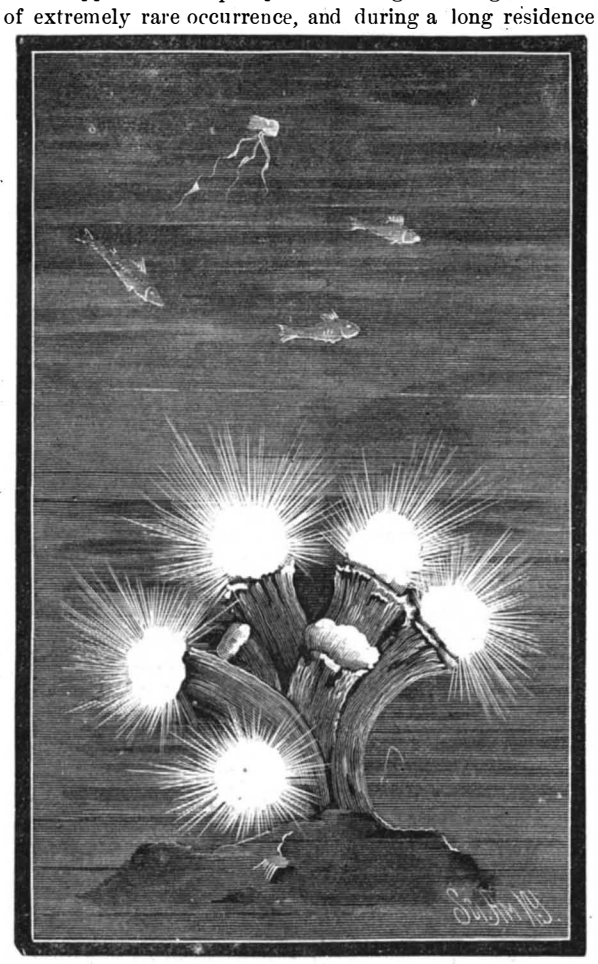
To color the article at the same time the paste is colored and poured or pressed into the form, and then the ground mass poured in as in making terra-cotta, where the finer parts are first filled up with prepared clay, which can be colored at will, and then filled out with ordinary clay that has not been elutriated.

It is well known that silicate of alumina, and also clay, when mixed with water glass solution, hardens and does not readily get soft in water. The strength and durability and power of resisting water is not, of course, equal to that which can be attained by burning. W. I. G. Z.

A PHOSPHORESCENT CORAL AND OTHER MARINE PHOS-ANIMALS.

BY C. F. HOLDER.

The appearance of phosphorescent light among corals is of extremely rare occurrence, and during a long residence



in the coral country, and of continued observation, the phenomenon was only observed once, and that in the genus *Caryophilla*. The specimen was first seen from the boat in about thirty feet of water, and brought up by diving, by the writer, and immediately placed in a jar of water, and finally transferred to an aquarium that had been built so that the tide rose and fell in it. Here the beautiful specimen was lodged, so that every movement of the animal could be observed. It had five branches, each one forming a cell showing beautiful radiating plates, striated externally, and collected into a solid conical polyparium fixed at the base.

The appearance of the animal when extended, though extremely attractive, did not come up to the one described by Professor Johnson, of London. "When taken," he says, referring to one dredged in deep water by Professor Travers, "the animal was scarcely visible, being contracted; when expanded, the disk was conspicuously marked by two dentated circles of bright apple green, the one marginal and outside the tentacula, the other at some distance from the transverse and linear mouth."

In the specimen kept by the writer the green was only faintly observed; and when the animal was within its cell the color of the mass was more inclined to yellowish brown, while two of the branches were denuded of animal matter, and were pure white.

The situation of the coral was about a foot under the surface, and a platform had been arranged so that the observer could watch it from the water's edge, and while so doing the light was first seen. At first we thought it might have been the phosphorescent flash of some minute acaleph, myriads of which were floating about, but to remove all doubt a glass funnel, slightly tinted, was gently lowered down over it, and a second later a slight flash illuminated it, and then another, showing a faint light that made small objects visible in the immediate vicinity of the polyp; and at one time a pteropod was suddenly thrown into a brilliant light when within a few inches of it. The flashes seemed to be intermittent, and to pervade the entire face of the cell in much the same fashion as does the light of the firefly the surface of that insect. By lowering a black glass near it an idea was obtained of the size of the reflection which was on the glass, an oval illuminated spot seemingly about the size of a silver quarter, and the color of the spark yellow, with perhaps a bluish tint.

In the accompanying illustration we have attempted to merely show the size and appearance of the illumination as it appeared twelve inches under water. The cause of this curious phenomenon is probably the same here, in a general sense, as in other forms. Perhaps there are special organs, as has been suspected in some of the acelphs, or it may be due to some fatty degeneration of the parts. In the sea pens (*Pennatulidæ*) the same phenomenon has been noticed, and a recent Arctic exploration discovered one of these curious creatures growing about four feet in height in water nearly a mile deep. The one known to science as *Renilla reniformis* is a rich purple species found off the coast of South Carolina. According to Agassiz it is remarkably phosphorescent, showing a golden-green light of wonderful softness. Another—the *Pennatula phosphorea*—is found in European waters of a rich red-purple color. Dr. Grant, in speaking of them, says: "A more singular and beautiful spectacle could hardly be conceived than that of a deep purple (*P. phosphorea*), with all its delicate transparent polypi expanded and emitting their usual brilliant phosphorescent light, sailing through the still and dark abyss, by the regular and synchronous pulsations of the minute fringed arms of the whole polypi."

Linnæus says that "the phosphorescent sea pens which cover the bottom of the ocean cast so strong a light that it is easy to count the fishes and worms of various kinds that sport among them."

One observer has been fortunate in discovering evidence of phosphorescent light in the boring mollusk pholas, having seen a faint flame or light playing about the entrance to its retreat; but the most wonderful of all the light-givers of the ocean are certain forms of ascidians. A compound one, the *Pyrosoma*, has been found, in the shape of a barrel, nearly five feet in length—an aggregation of many thousands of individuals. Huxley says of this interesting form: "The ascidiarium of *Pyrosoma* has the form of a hollow cylinder, rounded and closed at one end, truncated and open at the other, formed of a firm and transparent texture, in which the zooids are arranged in whorls; their oval apertures open on the exterior surface, and their atrial apertures into the interior of the cylinder. The hæmal aspect of each zooid is turned toward the closed end of the cylinder. The branchial sac has the ordinary structure, and each zooid is provided with a testis and with an ovisac containing a single ovum." To move along each zooid draws in water through its oval aperture and discharges it into the interior of the cylinder. The effect of so many currents being forced out of the open end propels the whole mass ahead in the direction it happens to take. Each of these zooids sometimes shines with a brilliant flame, so that at a distance through the water they have the appearance of great fire balls moving to and fro. The naturalist Bennet thus speaks of them: "I threw the towing net over the stern of the ship, which soon cleaved through the brilliant mass, the disturbance causing strong flashes of light to be emitted. On taking the towing net in it was found to be half filled with *Pyrosoma atlanticum*, which shone with a beautiful pale greenish light. After the mass had been passed through by the ship the light was still seen astern. The second occasion of my meeting these creatures," he says, "was in high latitude and during the winter season. It was on the 19th of August, the weather dark and gloomy, with light breezes from north-north-east, in lat. 40° 30′ S. and 138° 3′ E. long., at the west entrance of Bass's Straits, and about eight o'clock, when the ship's wake was perceived to be luminous, while scintillations of the same light were abundant all around. To ascertain the cause I threw the towing net overboard, and in twenty minutes succeeded in capturing several pyrosoma, which gave out their usual pale green light; and it was no doubt detached groups of these animals which were the occasion of the lights in question."

Humboldt also attests to the wonders of the colony of animals: "Only imagine," he says, "the superb spectacle we enjoyed when, in the evening from six to eleven o'clock, a continuous band of those living globes of fire was passing near our vessel. With the light which they diffused we could distinguish at a depth of fifteen feet the individuals of thymnus, pelamys, and sardon, which have followed us these several weeks, notwithstanding the celerity with which we sailed. Among these are other free swimming ascidians, as the salpa—animals that join in long bands, and from the masthead look like fiery serpents, winding their way through the sea. Myriads of jelly fishes add to the wonders of this submarine festival, and oval forms of red, blue, yellow, and green tints are seen rising and falling—veritable constellations of the sea; while the waves, charged with disconnected masses, break and roll away, lighting up the darkness with a ghastly glare that is reflected by the masts, sails, and rigging, that cast strange shadows over the deck and sea. The office of this strange light is mere speculation, as some fishes show the same, and many forms from great depths of the ocean. It has been surmised that its purpose is to provide light for those regions never to be explored and of utter darkness.

THE boiler of the Missjou Soap and Candle Works, on Sixteenth street, between Folsom and Harrison streets, San Francisco, Cal., blew up about 4 o'clock A.M., December 7. No one was injured. The building, which was worth $3,000, was demolished. The machinery, valued at $50,000, was more or less damaged.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

See Baker's Telephone adv., p. 44, last number.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 44.

Light and Fine Machinery and Tools to Order. Lathe catalogue for stamp. E. O. Chase, Newark, N. J.

Manufacturers of Drain Tile Machinery will please send address to C. G. Metzler, Columbus, Kan.

For Machinists and Apprentices.—The Student's Illustrated Guide to Practical Draughting. Sent on receipt of $1. T.P.Pemberton, 142 Greenwich St. P.O.Box 3083,N.Y.

Our goods speak for themselves, and a trial will convince the most skeptical of their superiority over all others. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Wanted.—A Second-hand Bicycle, about 46 in. wheel. Address, with price, Box 31, Phoenix, Arizona.

Caution to Manufacturers and Others.—The attention of those interested is called to the fact that materials for covering hot air and steam pipes, boilers, etc., which purport to contain asbestos, should bear the name of H. W. Johns, 87 Maiden Lane, N. Y., who is the inventor and patentee of genuine asbestos materials, comprising paints, roofing, steam packing, millboard sheathings, etc.

Chemist's Pocket Book.—For Chemical Manufacturers, Metallurgists, Dyers, Distillers, Brewers, Sugar Refiners, Photographers, etc. By Thomas Bayley. $2, mail free. E. & F. N. Spon, 446 Broome St., New York.

Patent Wanted.—I want to buy whole or part interest, or manufacture on royalty. Address H. C. Lyon, New York.

Manufacturers, Steam Boiler Owners, Towns and Cities desiring pure water, send for circular to the Newark Filtering Co., Newark, N. J.

For Sale Cheap—6 Lathes, 2 Planers, 5 Upright Drills, 1 Fowler Press. All on hand. York & Smith, Clevel'd, O.

Malleable and Gray Iron Castings to order, by Capital City Malleable Iron Co., Albany, N. Y.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch,Phil.

For Power & Economy, Alcott's Turbine, Mt.Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Lightning Screw Plates and Labor-saving Tools, p. 30.

Send for Pamphlet of Compilation of Tests of Turbine Water Wheels. Barber, Keiser & Co., Allentown, Pa.

List of Machinists in United States and Canada, just compiled; price, $10. A. C. Farley & Co., Philadelphia.

Presses & Dies (fruit cans) Ayar Mach.Wks., Salem,N.J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The Medart Pat. Wrought Rim Pulley. See adv., p. 44.

Abbe Bolt Forging Machines and Palmer Po ver Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

For Belt Studs, Belt Hooks, Belt Couplers, Belt Punches. Baxter Wrenches, write Greene, Tweed & Co., N.Y

The Sweetland Chuck. See illus. adv., p. 450.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

4 to 40 H. P. Steam Engines. See adv. p. 382.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Rollstone Mac. Co.'s Wood WorkingMach'y ad. p. 12.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

See Bentel, Margedant & Co.'s adv., page 46.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Cope & Maxwell M'f'g Co.'s Pump adv., page 45.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 412.

Saw Mill Machinery. Stearns Mfg. Co. See p. 29.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S.C.Forsaith & Co.,Manchester,N.H., and N.Y.city.

Supplee Steam Engine. See adv. p. 30.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville,N.J

Peck's Patent Drop Press. See adv., page 30.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Telegraph, Telephone, Elec. Light Supplies. See p. 46.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 45.

Eagle Anvils, 10 cents per pound. Fully warranted.

Peerless Colors for Mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 45.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Leather, Rubber, or Cotton Belting, Linen Hose or Rubber Hose, write Greene, Tweed & Co., N. Y.

Safety Boilers. See Harrison Boiler Works adv., p. 44.

Engines, 10 to 50 H. P., $250 to $500. See adv., p. 46.

Metallic Letters and Figures to put on Foundry Patterns, all sizes. H. W. Knight, Seneca Falls, N. Y.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusement. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 45.

Upright Self-feeding Hand Drilling Machine. Excellent construction. Pratt & Whitney Co., Hartford,Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p.45.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Improved Skinner Portable Engines. Erie, Pa.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co.,430 Washington Av.,Phila. P.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 45. Totten & Co., Pittsburg.

Portable Power Drills. See Stow Shaft adv., p. 45.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 4.6

NEW BOOKS AND PUBLICATIONS.

SECOND ANNUAL REPORT OF THE STATE BOARD OF HEALTH, LUNACY, AND CHARITY OF MASSACHUSETTS. 1880. Supplement containing Report and Papers on Public Health. Boston. 1881.

The general report is brief, the bulk of the volume being given to special papers on the Pollution of Deerfield River and Miller's River; the Separate System of Sewage; Intermittent Fever in Massachusetts; School, house Sanitation; and the Health of Towns, with special reference to the Epidemic at Adams and the Sanitary Condition of Holyoke.

MECHANICAL INDUSTRIES EXPLAINED. By Alexander Watt. Edinburgh: W. & A. K. Johnston.

A scrappy sort of book for "the rising youth of both sexes," describing briefly a number of industrial processes, chiefly mechanical. The information is good so far as it goes, but the author's style, though less technical than in his "chemical industries," is not particularly well suited for juvenile reading.

DANGERS TO HEALTH: A PICTORIAL GUIDE TO DOMESTIC SANITARY DEFECTS. By T. Pridgin Teale. Philadelphia: Presley Blakiston.

A model book for its purpose. Indeed it is safe to say that an hour's study of its impressive and readily understood illustrations of sanitary defects in house drains, sewer connections, and the rest, will do more to open the eyes of householders, plumbers, and builders, to dangers to health through dishonest and ignorant work in sanitary appliances, than months of study of ordinary treatises on sanitary engineering and domestic economy. It is a book worthy of the widest circulation.

PRACTICAL LESSONS IN ARCHITECTURAL DRAWING. 33 full page plates and 33 woodcuts. By Wm. B. Tuthill. New York: William T. Comstock.

Assuming some knowledge of architectural drawing on the part of the learner, the author shows, by examples in several classes of construction, how to make working drawings and write the specifications for buildings. The examples give plans, elevations, sections, and details of frame, brick, and stone buildings.

A NEW SYSTEM OF VENTILATION. By Henry A. Gouge. New York: D. Van Nostrand.

Describes the principles, methods, and results of Gouge's system of ventilation, and contains a large amount of useful information and suggestion touching the necessity of ventilation and the vital value of fresh air.

PRESIDENT GARFIELD AND EDUCATION. HIRAM COLLEGE MEMORIAL. By B. A. Hinsdale, President Hiram College. Boston: James R. Osgood & Co.

A memorial volume of special interest to those who knew Mr. Garfield as schoolmate, teacher, and townsman.

THE OPEN FIRE PLACE IN ALL AGES. By J. Pickering Putnam. Boston.: James R. Osgood & Co. Quarto, cloth. $4.

An enlarged and very handsome edition of Mr. Putnam's volume published last year. The illustrations have been increased to over 300, comprising many contributions of specially fine and artistic work by modern architects as well as selections from the best work of earlier builders.

STEAM HEATING FOR BUILDINGS, OR HINTS TO STEAM FITTERS. By William J. Baldwin. New York: John Wiley & Sons.

A straightforward, plain, and practical handbook for the young steam fitter.

THE IRONMONGER'S DIARY AND TEXT BOOK FOR 1882. London: Office of the *Ironmonger*.

The fourteenth issue of the diary carries, in addition to its record pages and usual freight of advertisements, a summary of the British census of last year and an illustrated review (not altogether impartial) of some of the prominent systems of electric lighting.

THE PHOTOGRAPHIC AMATEUR. By J. Traill Taylor. New York: Scoville Manufacturing Company.

The author's editorial experience in connection with publications devoted to photography has been of service in the preparation of this manual. He tells what he has to say with commendable directness, and in terms which the amateur student of the art cannot fail to readily understand. Special attention is given to dry plate photography.

EL MAL DEL PINTO. Por Gustavo Ruiz y Sandoval, Medico de la Escuela de Mexico. Mexico. 1881.

In this very important contribution to medical science, which has been honored by a prize from the Mexican Academy of Medicine, the author gives a very exhaustive study of a peculiar skin disease, which, although usually regarded as confined to Mexico, is here stated to be also prevalent in several parts of Central and South America. The disease (*mal del pinto*, or "blue stain," as it has been called in English is a contagious one, and manifests itself in the form of white, blue, or red patches on the feet, hands, and face, forming painful ulcerations, and giving the patient, as we should judge from the colored plates accompanying the memoir, a very unsightly appearance. In the more advanced stages the affection is accompanied by a sickening odor, the digestive faculty becomes impaired, the patient loses flesh and strength, and betakes himself to his bed, not to sleep, however, for extreme wakefulness is one of the symptoms of this stage. The cause of the endemic has not hitherto been well understood, but Dr. Ruiz in the work before us shows pretty conclusively from his microscopic examinations that it belongs to the category of zymotic diseases, and is produced by a fungus which he names *microsporum hidalgoense*. The affection appears to have no limit to its duration, and is cured only after long treatment by internal and topical remedies, leaving its traces then in the form of whitish cicatrices. As a prophylactic the doctor recommends that greater attention be paid to matters of cleanliness, public and private, and that certain forms of vegetable food, such as maize (which he believes harbors the fungus), should be strictly avoided. The memoir is finely illustrated, and is accompanied by a map showing the zone occupied by the disease.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA. Mexico. 1881.

The number before us of the Mexican Geographical Society's *Bulletin*, comprising parts 7, 8, 9, 10, and 11 of vol. v., contains several papers of more than ordinary value and interest, chief among which may be mentioned an important archæological memoir by Sr. Jose Ma. Reyes, wherein is traced the history of the immigration of the Pueblos to the American continent, and especially to the territory now occupied by the Republic of Mexico. The paper is well illustrated, and gives evidence of great painstaking research on the part of its author. The other papers are: "A Synoptical View of the State of San Luis Potosi," with various historical, geographical, statistical, and governmental data, by Sr. Rafael del Castillo; and an elaborate "History of the Beneficiary Institutions in Mexico," by Sr. Juan de D. Peza.

THE AMERICAN CHEMICAL JOURNAL. Edited by Professor Ira Remsen, of the Johns Hopkins University, Baltimore.

This ably-conducted journal, now in its third volume, has occupied a prominent place in the serial literature of chemistry from its very beginning. Each number contains original articles by prominent American and foreign chemists, reviews of works relating to chemical science, reports of progress in the various departments of chemistry, and items of general interest to chemists. The journal is a model of typographical excellence, and is published in numbers of from 64 to 80 pages, six numbers forming a volume, at the subscription price of $3.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) E. C. B. asks: 1. Can I put anything on wood to prevent it from becoming water soaked without changing the natural color of the wood more than varnish would? If so, what and how done? A. You can try the following process: Digest the wood for twenty-four hours or more in a hot solution composed of 1 pound of soap (white soap) dissolved in 4 gallons of soft water, and then for several hours in a solution of 2½ pounds of alum in 2 gallons of water. Finally rinse in running water and dry. 2. If I boil articles made of wood in linseed oil can I put a finish on it, or will the oil prevent me? A. You may encounter some difficulty in polishing wood that has been boiled in oil as proposed.

(2) J. C. S. writes: Will you please give me your opinion in regard to this new preservative "ozone," advertised in the papers? A. See answer to F. W., Jr., page 425 (26), volume xlv.

(3) W. St. asks: Is there any apparatus by which pieces of mineral or other substance of pea size can be heated by a continuous stream of hot air to from 280° to 350° Fah.? A. An apparatus for heating and employing hot air in the way proposed could be constructed without difficulty. It might resemble in some respects that employed in heating air for "hot blast" iron smelting furnaces. We think of no similar apparatus in use.

(4) E. C. B. asks: Please give me the cheapest process of japanning or blacking coppered wire like inclosed sample that has been injured by exposure. Can it be done by dipping, and without heating in an oven? A. The wire can be japanned in the way you propose. See "Japanning and Japans," in SUPPLEMENT, No. 316.

(5) S. P. C. asks: Will you please state the difference, if any, between "galvanized," "marblized," and "granite" ware? Are these safe and wholesome to be used for cooking purposes? A. Galvanized iron, so-called, is iron that has been coated with zinc by immersing the clear iron in the melted zinc. "Marblized" and "granite" are technical names given to an iron ware that has been coated with a vitrified porcelain-like composition of certain earthy silicates—the vitrification being accomplished by heating the coated articles in a muffle furnace or kiln. These latter wares are, as now manufactured, unobjectionable. The galvanized ware is not fit for culinary purposes.

(6) R. A. C. asks: Has double refraction, as exhibited by Iceland spar, ever been explained? I am unable to find the explanation in any of the treatises on optics which I have seen. I can explain and demonstrate it in several ways. A. The cause of double refraction is not a mystery. You will find the matter explained on page 325, vol. xlv., "The Nature, Formation, and Uses of the Nicol Prism."

(7) S. E. W. writes: I am running a circular saw mill with 22 horse power engine, 14 inches stroke making 166 revolutions per minute. Would like to obtain more power by increasing size of pulley on mandrel, and speeding up engine sufficiently to keep up same relative speed of saw. Can I with safety increase speed of engine 20 to 25 revolutions per minute? Have already increased speed of engine about 20 revolutions, and would like to add about 20 to 25 more, making in all about 180 revolutions. A. Yes, if well balanced, and fly wheel not too large.

(8) L. D. writes: We have a boiler, 6 feet diameter, 12 feet long, with 132 3-inch flues; the grate surface is 4 feet long by 4 feet 6 inches wide, and 22 inches from boiler; bridge wall 12 inches from boiler; rear or back wall is 14 inches from end of boiler. We have a brick chimney, 85 feet high by 40 inches square inside, in which is a damper 24 feet up from floor, or about 10 feet above bridging, which we can close to any desired opening. Now, if we burn coal we burn about 5,500 lb. per day, and then we use only about one-third of the power of engine; if we burn shavings from planing machines and sawdust from our factory, which is a sash, door, and blind factory, and a general woodworker, we can keep steam easier. Our fireman some way or another left the front doors open, and found the steam go up in hurry; he then fired a while that way, and found that he would burn a good less fuel by leaving the furnace doors open. He then told me about it, and I examined it and found it as he stated. Our engine is 20x30 slide valve; the air holes below grates are two, 14½x18 each. Now please tell us what is wrong. A. There is nothing particularly wrong, though we think you would do better with either wood shavings or coal by reducing the throat of the flue at the back end of the boiler from 12 inches height to 8 inches. You do not get air enough to the gases of your fuel. Put a lining plate to your furnace door; then drill in the door about eight holes, 1 inch diameter, and the lining with as many five-sixteenths inch or three-eighths inch holes as you can well put in. It will not then be necessary to leave the door open.

(9) D. D. D. writes: I am sinking a shaft through rock prospecting, and the water bothers me a great deal coming up through the holes we bore to blast with. Will you please inform me through your paper some cheap method of blasting so the water would not trouble? Can you inform me where I can get glycerine cartridges? A. Cartridges of dynamite or nitroglycerine are waterproof, and are generally employed for such purposes. See our advertising columns for addresses of manufacturers of these explosives.

(10) J. M. writes: 1. By putting iron and copper in contact, and allowing these metals to remain so, what effect would be produced on each? Would either corrode sooner, or otherwise? A. Under such conditions, if exposed to moisture, the metals form a galvanic pair, and the copper would in a measure be protected from corrosion at the expense of the iron; in other words, the iron would corrode faster than if not in contact with the copper. 2. In the event of zinc intervening would there be any change in the result? A. The zinc being the more positive of the series would be more rapidly oxidized, the other metals being to a certain extent protected thereby.

(11) J. J. writes: Turtles may be kept for four or five months headed in a cask three parts filled with salt water if the bung is left out. About a quarter of the salt water should be drawn off and replaced by fresh salt water once every month or two, if in the tropics. One which was treated in this way in a 250-gallon cask was pronounced by a turtle dealer in London to be as fine and fat a turtle as he had ever seen. It realized one shilling and two pence per pound live weight.

(12) C. H. L. asks: 1. What oil or substance could I use to mix with asphalt (Trinidad) to make a paint to be used cold, which could dry or evaporate, leaving the asphalt in nearly its natural state, so it would not run or soften under influence of sun's rays? Naphtha and turpentine are not satisfactory. Would resin oil answer? Am not familiar with its qualities. A. Common asphaltum contains moisture and volatile substances which must be eliminated before a good paint or varnish can be prepared with it. For the preparation of such a varnish see answer to E. H. L., page

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293 (17), vol. xlv. Resin oil can be used in connection with the bitumen, but a diluent, such as turpentine or naphtha, will be necessary. 2. After painting a roof, say with asphalt or coal tar, what wash (cheap white preferred) could I use over the asphalt, etc., to absorb the sun's rays? Wish some article in powdered form (so to be handily transported) which can be mixed with water as needed for use. A. As we understand you, fine chalk or potter's clay could be used. 3. I also inclose sample of saturated felt or paper. Would like to know, if possible, with what substance the felt is saturated. A. The felt is saturated with crude coal tar from gas distillation.

(13) N. L. writes: I made the induction coil described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, and it proves very satisfactory. Now I want to know if it will give satisfaction to produce electric light? What kind of regulator can I use? Can I use the Brush electric light regulator, described in SUPPLEMENT, No. 162? How many of the copper and zinc batteries must I use? A. You cannot produce an electric light of any power with an induction coil. Use a dynamo machine or battery. For a description of these and of the best kinds of lamps for regulators, see SUPPLEMENTS, Nos. 157, 158, 159, 162, 222, 224, and 225. Also "Simple Electric Light Apparatus," in No. 149.

(14) F. H. N. asks: 1. Where will I find complete directions for making a simple electric machine for electro plating and for electric light? A. See SUPPLEMENT, No. 161. 2. I have a gravity battery, the cells of which are 5x7 inches. What kind of a solution should I put in them? A. Put in 1½ lb. of sulphate of copper and fill the cell with water. 3. Could a tank be made of any very close grained hard wood for silver solution? A. No; wood of any kind gradually reacts on silver solutions and reduces them. See "Silver Plating," in SUPPLEMENT, No. 310.

(15) J. T. G. writes: My trouble is that my files rust after lying wrapped up in papers for some time. My method of putting them through after hardening is as follows: They are first put in dilute muriatic acid, then scrubbed with sand and water, then rinsed in clean running water and put in strong lime water, rinsed well in this and put before a fire to dry; the drying takes one minute to the one pound weight. After being dried the lime is brushed out of the teeth and they are oiled with castor oil, sometimes extra lard oil, but they will rust no matter which oil we use, and they turn brown after coming out of the lime, or before getting to the lime, although they are put through as quick as possible. What I want to know: is muriatic acid the best for cleaning files, and is there anything I can put in the lime that will destroy the acid and keep them clean and not liable to rust after being put through. Or can you give a better method of putting them through than the way I describe? Any information you can give through your valuable paper, the SCIENTIFIC AMERICAN, will be thankfully received by me. A. Rinse off the acid (muriatic) quickly in running water before putting in the lime water. Have the lime water boiling. The heated metal will dry spontaneously on removing it from this dip. Use lard, paraffine, or mineral sperm oils, or a mixture of these. If the oil is put on hot it will cover and keep the metal clean longer.

(16) G. B. writes: Is ozone made cheap enough to sell as an article of merchandise, and in what form is it best adapted to arrest all forms of decay? A. No; ozone or allotropic oxygen has only been observed as a gas. It has never been obtained in a concentrated form. The substance sold in the market as ozone appears to be sulphurous acid, or rather a preparation readily yielding that substance under favorable conditions.

(17) J. G. D. asks for a receipt for making a glue joint for wood work that is insoluble in water. A. You will find several good receipts for waterproof glue or cements under "Cements," in SUPPLEMENT, No. 158. See also "Cements," in SUPPLEMENT, No. 133.

(18) R. S. asks: 1. Is it as hard to fire on some ocean steamers as on a locomotive? What is the difference? A. Yes; and in hot weather, worse. 2. In large passenger steamers and merchant steamers what are the hours? A. When running, the hours are, generally, for long voyages, four hours on duty and eight hours off. On shorter routes, the "watch" is generally the length of the sun. 3. What pay, and are they in the same standing as the crew or sailors? A. From $30 to $40 per month. Firemen generally rate above deck hands.

(19) J. B. R. asks: Which is right: to blow the whistle, then start the machinery, in a manufactory, or start the engine first and then blow the whistle? A. Blow your whistle after your engine is in full operation. 2. A says that the diameter of a worm being larger or smaller increases or diminishes the speed of the worm gear the same as in spur gears or pulleys. B says it is not so. Which is correct? A. B is correct.

(20) J. H. F. asks: Has any substitute been used with advantage for the lime cylinders in the oxyhydrogen light? How would magnesite answer? A. See answer to J. A. L. (2), No. 1, current volume. Magnesite ground, pressed into form and calcined, can be employed instead of lime, but the cylinder so prepared would not stand the mechanical action of the flame as well as clear hard burned lime.

(21) A. P. S. asks: Will you let me know if there is any way to mend a crack in the face of a radiator? A. Try the iron cement recommended on page 2510, SUPPLEMENT No. 158.

(22) C P. K. asks for the best method of drying and sifting gravel for polishing sand. A. If large quanties are to be operated upon, a revolving cylinder over a fire, like a coffee roaster, would be good for the drying process. To this cylinder, laid at an angle and to its lowest end, attach wire gauze or grating, with sections of different size mesh—the finest mesh next the drying cylinder—and under these sections place pans to catch what falls through.

(23) H. A. S. asks: 1. At what speed should a No. 4 blower be driven for a twenty-six inch cupola? A. 1,800 to 2,000 revolutions per minute. 2. How far should it be placed from the cupola, and why? A. You may place it any convenient distance, say from 15 to 60 feet. 3. Does it make any difference if the blower is on the floor above the cupola and run the flues down? A. The blower should not be above the cupola, but rather below it, so that in case of stopping for any cause, the gas shall not collect in the blower.

(24) C. F. D. asks: 1. Is there any difference between one hundred pounds to square inch steam pressure and one hundred pounds cold water pressure? A. No. 2. If any difference, which tries the strength of boiler most? A. There is no difference, but it is generally admitted that the boiler is stronger at the temperature of the steam than when cold. 3. What is the difference, and why is there a difference? What cold water pressure should a boiler stand to be safe at 100 pounds steam? A. By government rule it should be tested to 150 pounds.

(25) J. B. P. asks: What is the average net profit on tanning a hide, the hemlock bark costing about $6 per cord? Of course, I know that sole, harness, kip, and calf require different amounts of bark. A. It is impossible to give definite information on this point, covering so great a business, extending all over the country. During the war, $1 a hide was made in some instances on sole leather tanning, but for the last year or two the business of tanning all kinds of upper leather has been a very close one, many old houses claiming that it has been done at a loss; while latterly, owing to the high price of hides, the best conducted sole-leather tanneries are making but the smallest margin of profit. The business is not one to embark in at any time with a view to speculative profits, in any locality, any more than is that of farming, and $6 is above the average cost of hemlock bark, unless delivered in cities.

(26) W. D. S. asks: 1. What is the highest working pressure it would be safe to carry on a boiler constructed of mercury flasks, as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 182. A. If properly connected, we think 200 pounds safely; but when complete they should be tested by water pressure to 50 per cent more than the greatest steam pressure you intend to use. 2. Could salt water be used in such a boiler? A. Not well. 3. Would I have to pay twenty-five dollars for a license if I used it in a boat sixteen or eighteen feet long? A. Yes; you would have to undergo the regular inspection.

(27) J. A. asks: Will you please inform me how to repair a bell that is cracked? Can I saw down the crack and fill with copper or brass, and make it hold and ring all right? It is a large bell, and is cracked about eight inches long. Please inform me what I can do with it. A. You cannot mend it as you propose. The only thing to be done is to drill a hole at the end of the crack, and cut down the crack to the hole with a saw, so that the edges of the crack will not touch each other in vibrating. This will enable the bell to ring, but it will not restore its original sound.

(28) C. H. asks: How much pressure will a boiler stand, 20 inches long by 8 inches diameter, made out of galvanized iron one-thirty-second of an inch thick, without any flues? A. By government rule 115 pounds per square inch; but as galvanized iron of this thickness is generally inferior quality, would not advise more than 80 to 90 pounds.

(29) J. E. K. asks: 1. What size screw propeller shall I use for steam launch 16 feet long, 5½ beam, engine 2¾? A. 18 to 22 inches diameter. 2. Will I have to pay the twenty-five dollars for license if I run the boat for my own use? A. Your boat must be regularly inspected and the fees paid, same as any other steamboat.

(30) A. P. J. writes: I am speeding up a circular saw, 20 inches in diameter, to be run by hand power and to saw cleft wood. I have a flywheel, 18 inches in diameter, weighing 80 pounds, to go on saw mandrel 3 feet long. How many revolutions should the saw make, and what the size of mandrel? A. If driven by power the saw might make 1,600 to 1,800 revolutions per minute. If you drive at any such speed you want no flywheel on the saw mandrel. The size of the eye of the saw will give size of the mandrel.

(31) R. W. D. asks (1) what the scale on the zinc in a Calland battery is; how can it be got rid of; and how often it should be removed. A. It is commonly composed of zinc, iron, and copper oxides. 2. What is the resistance of No. 32 (American) copper magnet wire per 1,000 feet? A. About 210 ohms. 3. In your answer to S. S. Mfg. Co. (4), page 11, current volume, should not ferrocyanide of potas., read ferricyanide of potas., or does the former act as well as the latter? A. Either will answer, but the ferrocyanide is preferred by many.

(32) C. S. G. writes: I have a number of musk rat skins, and am desirous of finding a cheap and easy plan of tanning them with the fur on for making carriage robe. A. Wash the skins in water, and cleanse them thoroughly by scraping or rubbing. Then rub well into the flesh side of the skin the following mixture: Alum, powdered, 2¼ pounds; salt and coarse wheat meal, each one pound; sour milk, q. s. to form a thin paste. When the skin will absorb no more of this preparation, spread a layer of the latter over it (on the flesh side), and fold up the skin with the flesh surfaces together and put it away in a cool place for a day. Repeat this pasting and rubbing each day for a week, washing out and half drying the skin every third day. Finally, thoroughly wash the skin in running water, drain; brush over it (flesh side) a strong solution of alum in water, and hang it up to dry. The dry skin is softened by rolling and pounding it with mallet or rubbing and stretching it with a flexible tool. It is commonly finished by rubbing down the flesh side with pumice stone.

(33) A. B. writes: Please give me a recipe for coloring chip straw black. I have tried several receipts, but instead of the braid being a nice black it has a purple tint. What I want is jet black like the imported goods. This braid is used in the manufacture of ladies' hats. What good work on coloring and bleaching can I consult? A. Use a small quantity of water containing 2¼ pounds logwood extract, 1 pound iron sulphate, and two-fifths pound verdigris. Put the straw into the boiling liquid for half an hour and then expose to the air for a like length of time, repeating this treatment for several hours, or until, on rinsing, the straw is found to have developed a suitable black. The color deepens considerably when the dyed straw is exposed moist for several hours to the air. See practical dyeing receipts in SUPPLEMENTS, Nos. 249, 207, 185, 228, 231, and 53.

(34) W. J. W. asks how to bronze zinc fret work. A. Coat the metal with very thin gold size, and when nearly dry rub on a sufficient quantity of red bronze (bronze powder) dry, and burnish. Bronze powders of almost any shade are procurable in the market.

(35) F. B. L. asks: 1. What is the cause of the snapping and cracking in steam pipes? A. Condensation of steam in the pipes. 2. What books are there published devoted wholly or principally to steam fitting? A. See "Roper's Engineer's Hand Book." Also "Baldwin's Steam Heating."

(36) A. S. writes: The statement has been made that the piston speed of engines, large and small, is now, or has been until lately, practically the same; this has been disputed. Will you please give the facts in the case, giving limits of speed of engines, say 8 inches by 16 inches, and 48 inches, by 96 inches or larger, and also state whether or not the tendency is to increase the piston speed in all engines up to 36 inch stroke over former practice? A. The tendency of late years has been to increased speed. Formerly the average speed of piston was about 300 feet; it is now probably not less than 450 feet. Of course the speeds are generally suited to the work. Some run up to 700 feet and even more per minute.

COMMUNICATION RECEIVED.

On the Ocean Packet Line. By J. W. N.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 3, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Sawing machine, log, Halstead & Carpenter 251,872
Screw, jack, Coats & Vibbard 251,698
Screws or bolts, machine for rolling threads of, H. A. Harvey 251,874
Secondary batteries, automatic circuit breaker for, Maloney & Burger 252,004
Settling tank, A. E. Jones 251,717
Sewing machine castings, numbering, E. T. Thomas 251,745
Sewing machine fringing attachment, W. A. Estayer 251,852
Sewing machine lamp attachment, F. E. Frey 251,863
Sewing machine ruffler, M. Weiner 251,808
Shade roller, spring balance, D. E. Kempster 251,893
Shaft coupling, C. Q. Hayes 251,878
Sheet metal vessels, attaching bottoms and tops to, G. W. Knapp 251,896
Ships, construction of, R. P. Pictet 251,793
Ships, construction of, R. Wilcox 251,753
Shoe, rubber, A. Hutchinson 251,782
Shoe uppers, apparatus for turning the edges of, J. McGuigan 251,789
Shot case, C. C. Henderson 251,890
Shoulder brace and suspenders, C. W. Stevens 251,805
Shutter fastener, H. J. Fisher, Jr 251,854
Signal. See Telephone signal.
Signal, T. J. Costello 251,700
Signaling and circuit connecting apparatus, T. A. Watson 251,807
Snap hook, F. Frazer 251,862
Soda, manufacture of, E. Solvay 251,963
Soldering apparatus, A. Lusk 251,909
Sowing fertilizers, machine for, E. D. Mead (r) 10,001
Spindle bolster, G. Draper 251,842
Spring. See Bed spring. Car spring. Vehicle spring. Wagon spring.
Starch from grain, method of and apparatus for obtaining, G. Burkhardt 251,827
Station indicator, J. P. Edwards 251,707
Steam engine, Myers & Bradley 251,920
Steam engine cylinder, W. J. Allen 251,809
Step or stair, C. H. Gould 251,713
Still and attachment, oil, J. B. Dubler 251,770
Still, turpentine, L. Bellingrath 251,816
Stocking and method of manufacturing the same, J. Adams 251,685
Stool and chair, combined, E. Worch (r) 10,005
Stopper. See Bottle stopper.
Stove leg, J. A. Risdon 251,949
Stove lid, B. S. Koll 251,899
Stovepipe, A. Flohr 251,857
Strap fastener, J. B. Gathright 251,776
Suction elevator, H. R. Dulaney 251,844
Sulky, M. Payne 251,934
Tacking machine, E. Woodward 251,755
Tackle block, J. W. Norcross 251,926
Tally machine, J. W. Elliot 251,850
Tank. See Settling tank.
Telegraph cable terminal, W. R. Patterson 251,729
Telephone exchanges, automatic signaling circuit for, C. E. Scribner 251,955
Telephone signal, G. L. Anders 251,810
Telephone signaling, magneto-electric machine for, G. L. Anders 251,758
Telephone transmitter, battery, C. E. Scribner 251,800
Thermometer, volute tube, M. Immisch 251,839
Thill coupling, H. T. Perram 251,935
Thrasher and separator, combined, F. W. Robinson 251,951
Thrashing machines, cylinder and concave tooth for, H. P. White 251,981
Thrashing machines, self-feeder for, J. Scholl 251,799
Ticket holder, J. G. Tait 251,966
Tire tightener and spoke extractor, G. W. Linck 251,905
Tire upsetter, C. Stevens 251,964
Tongs, cattle, C. Brühl 251,825
Tool, combination, F. Emmenegger, Jr 251,851
Torpedo and detonating signal, railway, F. Gerard 251,868
Toy and bottle stopper, combined, F. C. Zanetti 251,757
Toy building blocks, F. W. Carpenter 251,763
Toy furniture, G. W. Lewis 251,903
Trace fastener, E. A. Pollard 251,937
Trichinoscope, Lomb & Bausch 251,721
Turpentine and rosin, apparatus for the manufacture of, A. Garner 251,865
Tuyere, T. H. Bullock 251,761
Twister frame spindle, J. B. Bancroft 251,815
Valve for steam engine, exhaust, C. B. Richards 251,948
Valve, relief, S. R. Kneeland 251,897
Vapor burner, E. O. Garland 251,709
Vapor burner, Schneider & Trenkamp 251,738
Vehicle spring, J. K. Chew 251,764
Vehicle spring board, G. E. Norris (r) 9,998
Vehicle wheel, Ball & Davis (r) 9,994, 9,995
Wagon or lifting jack, L. B. Hoit 251,882
Wagon running gear, A. Barnes 251,687
Wagon spring, N. Botsford 251,994
Walking stick, J. Draper 251,843
Washboard, P. T. Gates 251,710
Water closet, H. W. Atwater 251,813
Water closet, J. C. Daggett 251,999
Water closet, W. H. Daniell 251,767
Water heater and circulator, P. Smith 251,741
Water meter, piston, J. A. Tilden 251,971
Weeds and beans, implement for cutting, W. H. Clark 251,765
Wells, etc., portable drilling machine for oil, R. M. Downie 251,841
Whalebone, artificial, G. H. Phelps 251,731
Wheel. See Vehicle wheel.
Whiffletree hook, T. W. De Tray 251,769
Windmill, W. S. Baugh 251,688
Window frame and sash, F. W. Hettinger 251,778
Wood and metal, compound for preserving, L. D. Mott 251,918
Wood turning machine, G. P. Loomis 251,907
Wool washing machine, J. Clough 251,833
Woven fabrics, machine for turning and pressing, Tracy & Stillman 251,972

DESIGNS.

Bottle, caster, J. Hoare 12,651
Chain link, ornamental, E. F. Seery 12,653, 12,654
Cuff box, interior form of, I. P. Turner 12,655
Finger ring, Richmond & Carpenter 12,652
Fringe, G. E. Goucher 12,648
Fringe, J. C. Graham 12,649, 12,650
Glassware, J. Dalzell 12,647

TRADE MARKS.

Accordions, W. Spaethe 8,982
Chocolate, milk, Basley & McAlvanah 8,975
Composition for coating walls and ceilings, Alabastine Company 8,988
Cotton yarns and cloth, Globe Yarn Mills 8,993
Decorative fabric, certain, J. R. Whitley 8,987
Flax lint, W. G. Taylor 8,985
Furnaces, summer, C. Riessner 8,981
Galvanized sheet iron, St. Louis Stamping Company 8,984
Hats and caps, Steinfeld, Kernwood & Co 8,983
Liniment, J. W. Aitken 8,973
Medicinal preparation, certain, T. E. King 8,994
Metal ware, Plume & Atwood Manufacturing Company 8,980
Needles and Pins, G. A. Clark & Brother 8,976
Paints and pigments, Hore, Barnett & Co 8,979
Photographic prints, E. & H. T. Anthony & Co 8,974
Preparation for eradicating corns, Gray & Hoffin 8,978
Soap, A. B. Gillett 9,977
Soles, taps, and heels, G. A. White 8,986
Thread, Clark Thread Company ..... 8,989 to 8,991
Wines, C. F. Eccardt 8,992

English Patents Issued to Americans.

From December 27 to December 30, 1881, inclusive.

Brushes, W. H. Miles, New York city.
Electric clock, C. E. Buell, New Haven, Conn.
Fire extinguisher, H. S. Maxim, Brooklyn, N. Y.
Gores, gussets, etc., S. Florsheim, Chicago, Ill.
Grain shifting apparatus, W. H. Power, New York city.
Harmonica, M. Harris, New York city.
Leather dressing machine, F. B. Batchelder, East Boston, Mass.
Musical instrument, M. Harris, New York city.
Musical instrument, Automatic Music Paper Company, Boston, Mass.
Refrigerator, G. C. Roberts, New York city.
Shoe machinery, G. W. Copeland, Malden, Mass.
Steam engine valve, S. A. Goodwin, Philadelphia, Pa.
Steamships for carrying fruit, G. A. Cochrane, N. Y.
Telegraph, H. Van Hoevenburgh, Elizabeth, N. J.
Timepieces, W. E. Doolittle, West Haven, Conn.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Perfect in every particular. 200,000 sold yearly.
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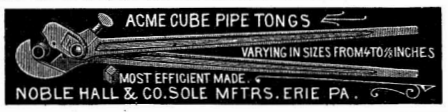
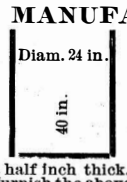


TO GLASS MANUFACTURERS.



Tank of coarse glass half inch thick, with solid bottom. Any party who can furnish the above, address Roxburgh & Glover, P. O. Box 402, Charleston, S. C., U. S. A.

The Sun.

NEW YORK, JANUARY, 1882.

THE SUN for 1881 consumed four million one hundred and ninety-four thousand three hundred and ninety-one (4,194,391) pounds of printing paper in its Daily, Sunday, and Weekly editions.

This is equal to sixty million seven hundred and seventy-two thousand six hundred and seventy-seven (60,772,677) copies of the daily size.

The actual circulation for the past year was:

Daily, - - -	39,701,161
Sunday, - -	7,037,604
Weekly, - - -	3,498,154

This gives for each day in the year the following average:

Copies of the Daily edition, 126,841
Copies of the Sunday edition, 135,339
Copies of the Weekly edition, 67,273

THE SUN has advertising space to sell. In the Daily and Sunday editions its price for ordinary advertisements is **40** cents per agate line. Preferred positions and displayed matter from 50 cents to $2.50 per line. In the Weekly 50 cents an agate line of space; no extra charge for display. Preferred positions 75 cents to $2 per line.

At this price advertising in the several editions of THE SUN is cheaper than its publisher has ever been able to obtain in any other medium, and he has spent hundreds of thousands of dollars in making known THE SUN, and the advantages it offers to the business community.

THE SUN is published every day in the year, at Nos. 166, 168, and 170 Nassau Street, New York City.

I. W. ENGLAND, Publisher.

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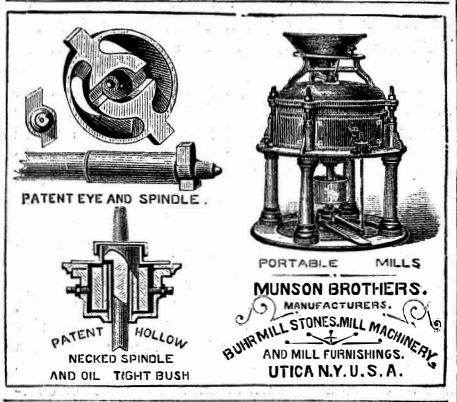
LEHIGH AVE. & AMERICAN ST. PHILA.

15c. "A Violet from Mother's Grave," & 49 other popular Songs, words and music entire, all for 15c. PATTEN & CO., 49 Barclay St., N. Y.

VALUABLE PATENTS for sale or to let on royalty. Send for circulars. Patents sold on commission. CHAMBERLIN & CO., Brokers, 34 Park Row, New York; 112 South 4th Street, Philadelphia, Pa.



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SHORTHAND Writing *thoroughly taught* by mail or personally. Situations procured for pupils when competent. Send for circular. W. G. CHAFFEE, Oswego, N.Y.

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$777 a Year and expenses to agents. Outfit free. Address P. O. VICKERY, Augusta, Me.

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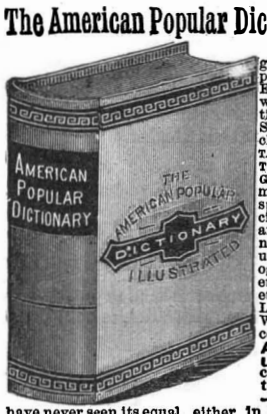
The American Popular Dictionary, $1.00



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For Dry Steam Portable Engines,
FOR CIRCULAR SAW MILLS,
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Joint Stock Companies formed. Stock placed for Incorporated Companies. Good investments always on hand. Highest references given. Circulars free. E. L. RICHARDS & CO., Brokers 233 BROADWAY New York.

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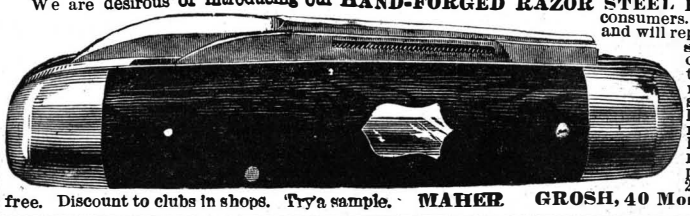

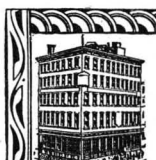

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5 The Old Cabin Home.
6 The Little Ones at Home.
12 See That My Grave's Kept Green.
13 Grandfather's Clock.
18 Where Was Moses when the Light
24 Sweet By and By. [Went Out.
26 Whoa, Emma. [Maggie.
33 When you and I were Young
36 When I Saw Sweet Nellie Home.
48 Take this Letter to My Mother.
49 A Model Love Letter,—comic
53 Wife's Commandments.—comic.
54 Husband's Commandments.
56 Little Old Log Cabin in the Lane.
58 Marching Through Georgia.
60 Widow in the Cottage by the Sea.
65 The Minstrel Boy.
70 Take Back the Heart.
72 The Faded Coat of Blue. [Night.
77 My Old Kentucky Home. Good
84 I'll be all Smiles to Night Love.
86 Listen to the Mocking Bird.
93 Her Bright Smile Haunts Me Still
94 Sunday Night When the Parlor's
95 The Gypsy's Warning. [Full.
102 'Tis But a Little Faded Flower
104 The Girl I Left Behind Me.
105 Little Buttercup.
107 Carry Me Back to Old Virginny
112 The Old Man's Drunk Again.
116 I Am Waiting, Essie Dear.
119 Take Me Back to Home & Mother
120 Come, Sit by My Side, Darling.
121 Kiss Me, Kiss Your Darling.
123 A Flower from Mother's Grave.
124 The Old Log Cabin on the Hill.
130 Coming Thro' the Rye,
131 Must We, Then, Meet as Strangers
138 The Kiss Behind the Door-
139 I'll Remember You, Love, in My [Prayers.
146 You May Look, but Musn't Touch.
150 There's Always a Seat in the Parlor for You.
152 I've no Mother Now, I'm Weeping
158 Massa's in de Cold, Cold Ground.
159 Say a Kind Word When You Can.
165 I Cannot Sing the Old Songs.
166 Norah O'Neal.
167 Waiting, My Darling, for Thee.
169 Jennie the Flower of Kildare.
170 I'm Lonely Since My Mother Died
172 Tenting on the Old Camp Ground.
176 Don't You Go, Tommy, Don't Go.
180 Willie, We have Missed You.
182 Over the Hills to the Poor House.
185 Don't be Angry with Me, Darling.
191 Flirtation of the Fan.
194 Why did She Leave Him? [other.
196 Thou Hast Learned to Love An-
203 There's None Like a Mother.
204 You Were False, but I'll Forgive.
209 Whisper Softly, Mother's Dying.
211 Will You Love Me, When I'm Old.
220 Annie Laurie.
222 Sherman's March to the Sea.
224 Come, Birdie, Come.
228 Love Among the Roses.
232 Old Arm Chair (as sung by Barry.)
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242 Farmer's Daughter; or Chickens
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252 Darling Nellie Gray.
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260 Sadie Ray.
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280 The Sweet Sunny South.
283 Come Home Father.
284 Little Maggie May.
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288 Sally In Our Ally.
289 Poor Old Ned.
292 Man in the Moon is Looking.
295 Broken Down.
300 My Little One's Waiting for Me.
301 I'll Go Back to my Old Love Again
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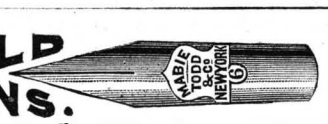

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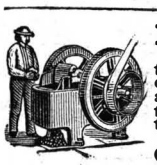

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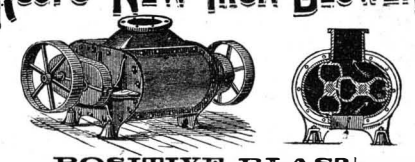

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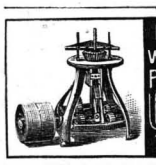

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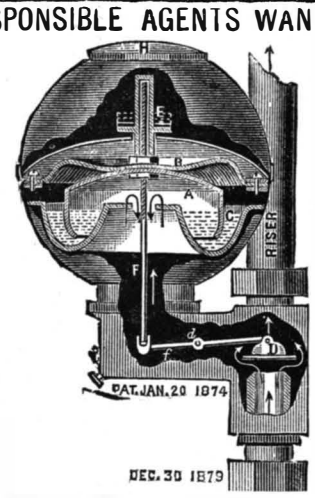

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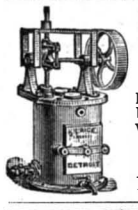

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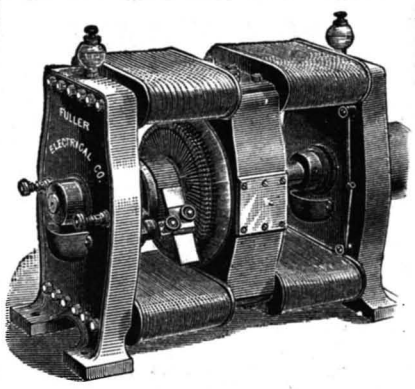

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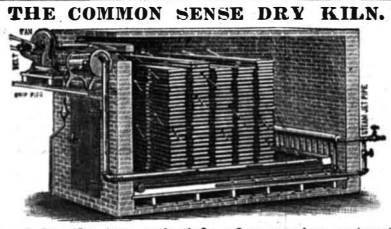

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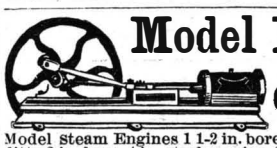

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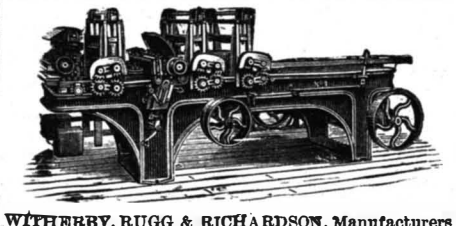

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